AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS, AND BLACKSMITHS.

VOL. 10, No. 8 WEEKLY. | NEW YORK, FEBRUARY 19, 1887. | $2.50 per Annum. SINGLE COPIES, 5 CENTS.

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New Boring and Turning Mill.

Vertical boring and turning mills for finishing large pulleys and similar classes of work are fast superseding horizontally arranged machines, owing to the greater facilities with which they can be used, and the much greater quantity of work that can be done on them. First the work is more readily set in position on a vertical than on a horizontal machine, and second it is more readily come at by the cutting tools. The use of two cutting tools, operating at the same time, is also very conveniently brought about in vertical machines.

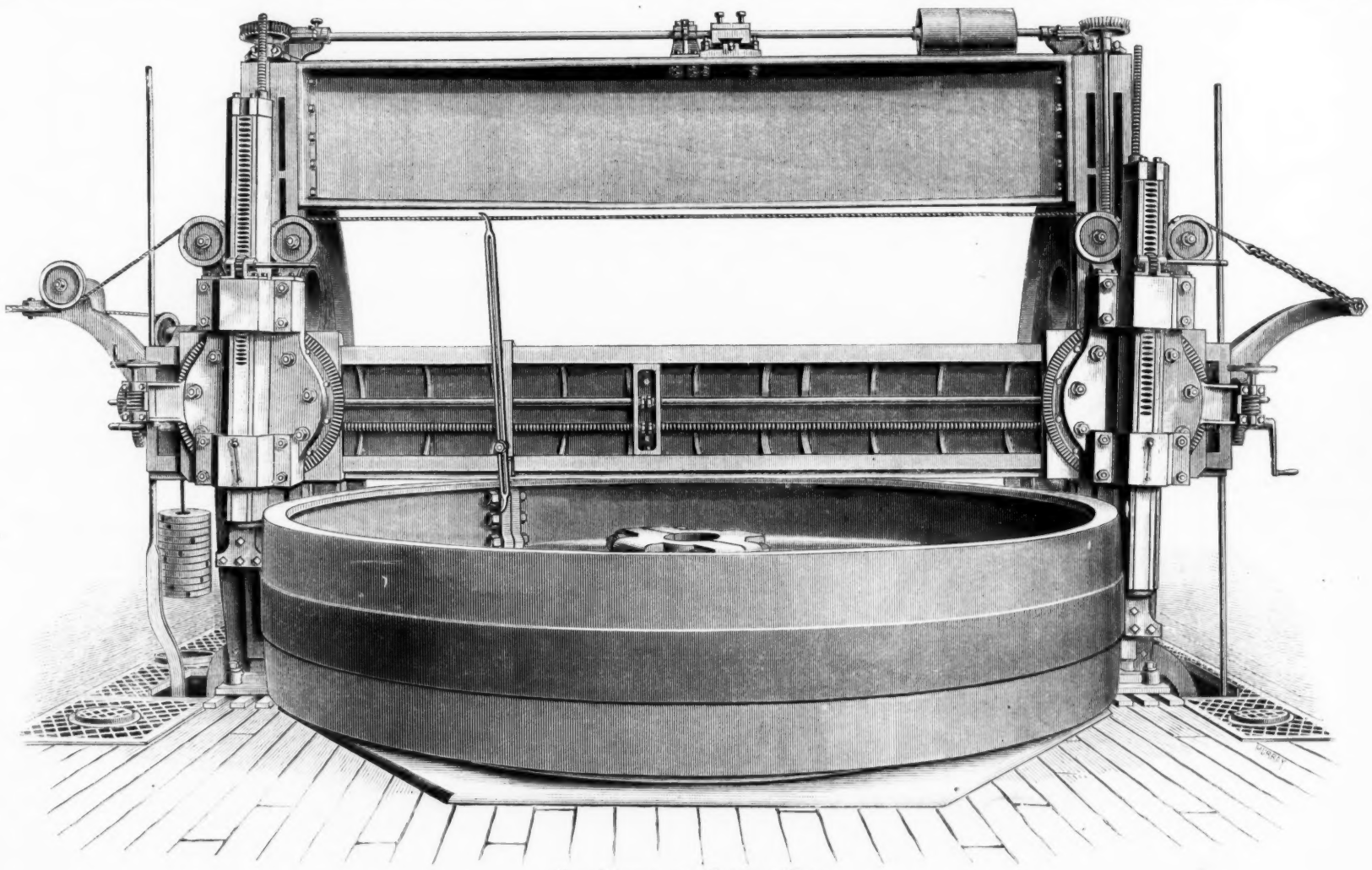
The illustrations, pages 1 and 2, represent a vertical boring and turning machine, built by the Pusey & Jones Co., Wilmington, Del. In the engraving on page 2 a half-wheel 16 feet diameter, 38 inch face, is represented as being turned off for fitting the halves together. This is very easily accomplished, as will be readily understood from the engraving. This provides a convenient means for fitting half-wheels together—a job often done by the tedious process of chipping.

The engraving on page 1 shows the same wheel while undergoing the operation of turning—one tool working up from the bottom while the other is moving down from the top.

In this machine the driving gear is arranged to give a range of ten different speeds. The feed is automatic in all directions, and has a range from $\frac{1}{16}$ inch to $1\frac{1}{2}$ inch. The face-plate is $10\frac{3}{4}$ feet diameter, with radial slots for clamping work. The housings are 16 feet apart, and the greatest distance from face-plate to under side of cross-head 9 feet. The spindle is carried on a steel step.

This machine will bore and turn a wheel up to 25 feet diameter, and 9 foot face; we are also informed that it has been successfully used for turning and facing flanges on ends of a gas meter case 12 feet 9 inches diameter, and 12 feet 9 inches in height.

It requires a floor space of 26 feet 6 inches by 29 feet, and is 22 feet 6 inches high from floor to top of tool bar.



NEW BORING AND TURNING MILL.

Suggestions in Machine Design.

V.

BY A. J. SHAW.

Make clearances ample, especially between unmachined surface. Clearances shown + on drawings are only too apt to be — in the machine.

The heavier and more massive the work, the larger the clearances.

A chipped clearance is like a blot on a fair page—an unsightly blemish.

The draftsman is not always the one who should be blamed for interferences; when his superiors, or others, make changes in his work, during the process of construction, without consulting him, they must take their chances.

The designer, if worthy of the name, should be consulted concerning all changes made in at least the first construction of his work after it leaves his hands as a matter of business policy if for no other reason.

He has studied the design more carefully than any one else is likely to have done, and is more familiar with its difficulties and peculiarities. He has selected each detail from many other arrangements, as presenting the greatest balance of advantages, and the alteration suggested may be to one of those which have been rejected for good reasons.

It is often the case that clearances must be made smaller than desirable, even at some risk of interference, as an increase cannot be had except by sacrificing other advantages which it is important to retain.

Clearances are usually arranged with the expectation of obtaining reasonably good work from the foundry and smith shop, in default of which there may be trouble.

When there is any doubt as to the sufficiency of a given clearance increase it if possible.

"Barely enough to pass" will fail to pass, nearly always.

High speed belts occupy but a line on paper; in the machine they occupy all the space there is, and, like the immortal Oliver, ask for more.

When not running belts extend in a straight line from pulley to pulley; when in rapid motion the centrifugal action set up causes them to "throw" away from the pulleys and spread out, thus widening the space occupied.

For this reason, while standing parts of the machine may be located within a moderate distance of, if between, the belts, on the outside ample space should be given them.

High speed belts, if of leather, should be cemented, not laced, and of the best and most carefully selected material.

Belts which are spongy in spots, uneven in thickness, or which stretch more on one side than on the other, are sure to run badly and give trouble.

As the capacity of a belt is dependent, not on its width, but on its sectional area, in cases in which a single belt would be of inconvenient width or an ordinary "double" belt of too great rigidity, two single belts may be used, one running outside of and upon the other. The belts should not be fastened together in any way, but each should run independently of the other. The sum of their widths may be equal to that of the single belt required to do the work. It is better that the under belt should be a little wider than the upper.

This is often a very satisfactory method of reinforcing a single belt which is insufficient to do the work required of it.

On account of the "throwing" of the belt away from the pulleys, and the increased tension, due to centrifugal force, a high speed belt will not transmit as much power for a given product of width and velocity as one running at a lower speed.

At 3000 feet per minute this loss amounts to about one-eighth ($\frac{1}{8}$), while at 6000 feet per minute the loss is nearly five-twelfths ($\frac{5}{12}$); so that to transmit a given power at the latter velocity, a belt must be made one and five-sevenths ($1\frac{5}{7}$) the width determined by the usual rules.

The tendency of modern design and practice is towards narrow fast running belts on

large pulleys, as being more satisfactory and economical than the contrary arrangement.

Do not use short quarter twist or crossed belts when it is possible to avoid them.

Sliding pieces should be guided by few and approximate, rather than by many and widely separated surfaces, if the principal forces acting upon it are parallel to the line of movement. The extension should be in the direction of motion rather than at right angles to it.

If, however, there are deflecting forces acting across or at right angles to the direction of motion, the guides for resisting those forces should be widely separated in order to diminish the intensity of the load upon them.

The planes of guiding surfaces should be normal or nearly normal to the direction of pressure.

The change from the usual double ∧ guiding of the carriage of engine lathes to a single ∧ at front and flat slide at back is only a question of time.

ing more. Odd thousandths, sixty-fourths or thirty-seconds, even, are a nuisance in most shops, especially on heavy work.

The old adage that "first thought is best" is not often true in machine design. A good design is usually a growth, seldom an inspiration; although its central idea may be.

He who always employs the first method that suggests itself is either a genius or—a crank; it is sometimes difficult to determine which.

The best results are usually reached by elimination.

Seek to make your work as nearly perfect as possible, within your limitations; but do not forget that the search after absolute perfection, like that after the philosopher's stone, is an endless one.

Use standard threads on screws and bolts when practicable.

Do not multiply sizes of bolt heads and nuts on one machine, especially if it is to be accompanied by solid wrenches. Wrenches not in constant use are likely to be lost or

reached by the operator from his usual position.

On machine tools, and many other machines, there are positions and directional movements for operating and adjusting cranks and handles in constant use, to which we have become so accustomed by long habit that to reach for and move them in the right direction is more automatic than a matter of conscious reflection.

These should not be departed from except for the best of reasons.

Handiness often counts for more than merits of greater actual importance.

When change gears are used on a machine, it is a point gained if they can be so arranged that but one gear need be changed for the usual variations.

As a rule, each adjustment of a machine should be independent of, and should not disturb that of other parts.

That this is not always considered is evidenced by a certain automatic machine which is so arranged that, for any change in the

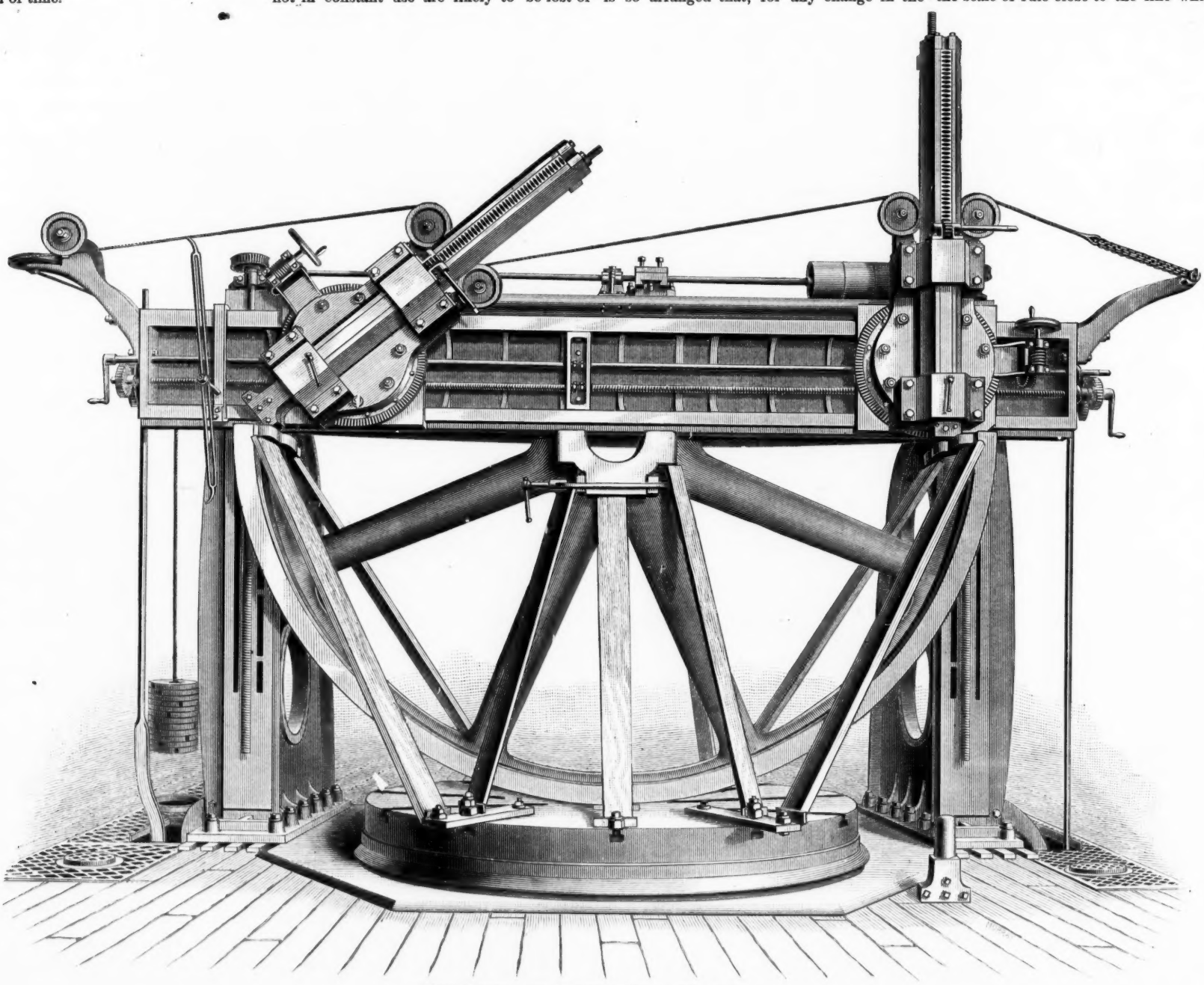
Practical Drawing.

By J. G. A. Meyer.

Seventeenth Paper.

164. When it is necessary—which sometimes will occur—to draw a small scale, say $\frac{1}{2}$ inch, $\frac{3}{8}$ inch or any smaller scale, it will be a difficult matter to divide such short distances into 12 equal parts, each of which is to represent one inch. Now, to avoid in a great extent this difficulty, a form of scale as shown in Fig. 126 is often adopted, in which a half inch or any other shorter distance can be easily and accurately divided into 12 equal parts.

The only objection to these scales is that these are not so convenient to use as that represented in Fig. 123, because as will presently be seen scales like that shown in Fig. 126 cannot be used in a manner similar to that of using an ordinary rule, namely by holding the scale or rule close to the line which is to



New Boring and Turning Mill—See Page 1.

Power and resistance should be applied in as nearly the same line as possible.

Ease in replacing and repairing calls for subdivision, but how far subdivision should be carried for this purpose must be decided separately for each case.

The constructional necessity for building up and subdivision is in inverse ratio to the shop facilities and skill at the command of the manufacturer.

In large constructions, built up work is often stronger than that made in one piece, on account of its greater soundness.

Unless there are reasons to the contrary make all dimensions to whole or as large fractional units as possible. This is particularly important for long measurements.

Giving the length of a shaft to feet, inches and sixty-fourths, when there is no reason why it may not be an eighth or a quarter of an inch longer or shorter, is an absurdity if nothmislaid; and even if they are at hand, it is less convenient to change than to use a single wrench for all adjustments.

This is especially true of machine and other tools on which frequent changes are required.

There are lathes in the market by makers of great reputation and undoubted excellence, the screw-cutting gears on which are so arranged that it requires the use of both the tool post and tailstock wrenches to change them.

The most convenient thing is a monkey wrench.

This is a piece of awkwardness, for which there is no necessity; nor is there apparently an excuse for its continuance.

When possible—and it is in most cases—so locate all handles, levers, cranks, etc., controlling the action or adjustments of a machine, that they can be conveniently

length of the piece operated upon—a thing of frequent occurrence—there must be readjusted at least three, and sometimes six, stops; the maladjustment of any one of which is likely to be the cause of a break-down, or of spoiled work.

Other things being equal, that tool or machine is best which requires the fewest adjustments in changing from one piece or class of work to another.

The 1887 catalogue of the American Society of Mechanical Engineers shows a total membership of 714, of which 15 are honorary members, 7 life members 631 members, 27 associate, and 34 juniors.

The hammer makers of the United States recently held a convention. They are noted for causing strikes.

be measured, and thus at once obtaining its length.

165. When a scale of this kind is to be drawn we proceed in the following manner:

Let it be required to draw a $\frac{1}{2}$ inch scale.

Fig. 126. Draw any straight horizontal line as $A\ H$; commencing at the point A, lay off in succession on this line a number of points as I, 1, 2, etc., exactly $\frac{1}{2}$ inch apart; the distance from the point I to the point marked 1, or that between the points 1 and 2 will represent one foot. Our next step will be to divide the distance $A\ I$ (which also represents one foot) into 12 equal parts.

Through the point A draw the line $A\ G$, and through the point I draw the line $I\ K$, both perpendicular to the line $A\ H$. On the line $A\ G$ commencing from the point A lay off six points as b, c, d, e, f, and G, all equal distances apart; the distance between the points A and b may be $\frac{1}{4}$ or $\frac{1}{8}$ of an inch, or

any other convenient measure, but whatever measure we do adopt for the distance *A b*, must be adopted for each of the distances between the successive points *b*, *c*, *d*, etc. Through the points *b*, *c*, *d*, etc., draw straight lines parallel to *A H;* the line drawn through the point *G* will cut the line *I K* in the point *K*. Bisect the line *G K*, and thus obtain the point marked 6. Join the points *I* and 6 by a straight line ; also join the points *A* and 6 by a straight line. The points at which the line *I* 6 cuts the horizontal lines must be marked 1, 2, 3, 4 and 5. Also the points at which the line *A* 6 cuts the same horizontal lines must be marked 7, 8, 9, 10 and 11. Through the points 1, 2, 3, etc. on the horizontal line *A H*, draw lines perpendicular to *A H;* the scale is then complete.

166. The distance from the point marked 1 to the line *K I* measured on the line through *b* will represent 1 inch; the distance from the point 2 to the line *K I* measured on the line *c* will represent 2 inches, and in a similar manner any number of inches can be taken from this scale. When we wish to make the length of a line longer than 6 inches, say, for instance, 7 inches, we make it equal to the distance from the point 7 to the line *K I*, measured on the line *f;* or if the line is to be 11 inches long, we make it equal to the distance from the point 11 to the line *K I* measured on the line *b*. Again, if we wish to lay off a length of 2 feet 10 inches we make it equal to the distance between point 10 and the vertical line marked 2, measured on the line *c;* in a similar manner any number of feet and inches can be taken from this scale. Although in this class of scales the foot is easily divided into 12 equal parts, these scales are not so convenient to use as those illustrated in our last paper, because when the former is used all the distances, except those given on the lines *A* and *G*, must be taken off with the plain dividers, and then transfered to the given line ; whereas, when the scale shown in Fig. 123 is used, we can lay it near any line and mark off any length we wish without using the dividers. Scales like that shown in Fig. 126 are sometimes called diagonal scales, because the foot is divided into inches by diagonal lines.

167. Right here it will be advisable to explain a few other tools which the student will need as he proceeds with these lessons ; in fact, the tools now to be explained, in addition to those shown in Figs. 35 to 63 will very nearly complete a draftsman's outfit, such as will be suitable for ordinary machine drawings. The tools not mentioned here will be explained at the close of these lessons.

168. Protractor, Fig. 127. In Art. 37 it is stated that angles are measured by degrees. Now, for the purpose of quickly ascertaining the number of degrees in an angle, we use the protractor.

Protractors are made of German silver, brass, ivory, horn, wood, paper and sometimes tracing paper.

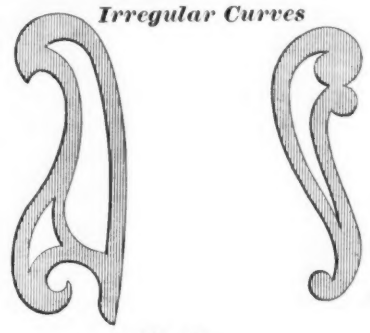
Protractors having a circular form, and protractors having a semicircular form can be obtained. When they have a circular form the circumference is divided into 360 equal parts, each part will then represent one degree (see Art. 37), each part is subdivided into two equal parts, each representing one half of a degree or 30 minutes. In some protractors the degrees are subdivided into a greater number of parts, but for ordinary machine drawings those having the degrees divided into two equal parts will answer all purposes.

When the form of a protractor is a semicircle, the semi-circumference is then divided into 180 equal parts each representing one degree as before, and the subdivision 30 minutes.

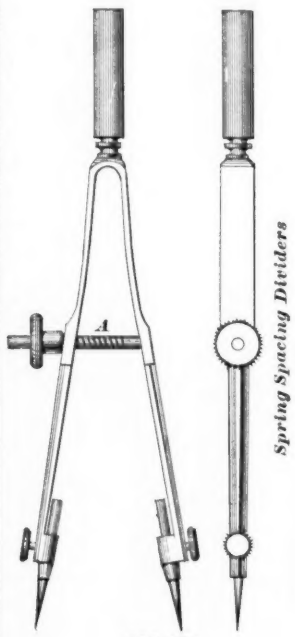
169. It will also be noticed in the figure that some of the division lines are longer than the others; with such an arrangement we can distinguish the number of degrees in an angle more readily and conveniently and with greater certainty. It will also be seen that on every tenth division the number of degrees is marked; in the outer row the numbers commence from the right hand end of the diameter, and in the inner row from the left hand end. With the numbers arranged in this manner we are enabled to read conveniently the number of degrees contained in an angle in whatever position the angle may be placed.

170. When the number of degrees in an angle are to be ascertained we proceed in the following manner: Let the line *B C* and *A C*, Fig. 127, be the sides of an angle, and *C* its vertex, it is required to find the number of degrees in this angle.

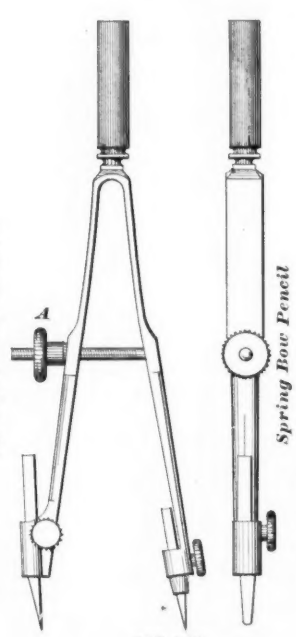
Irregular Curves



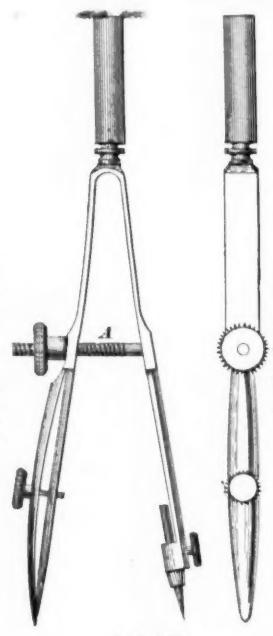
129–128.



130–131



132–133



134–135

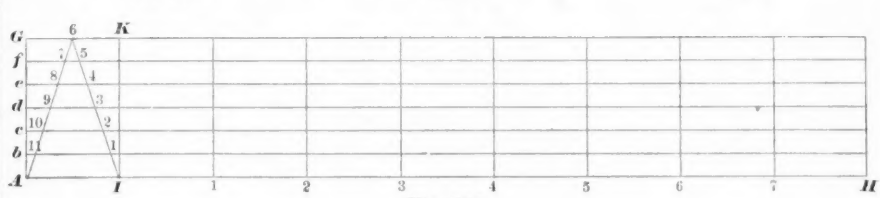
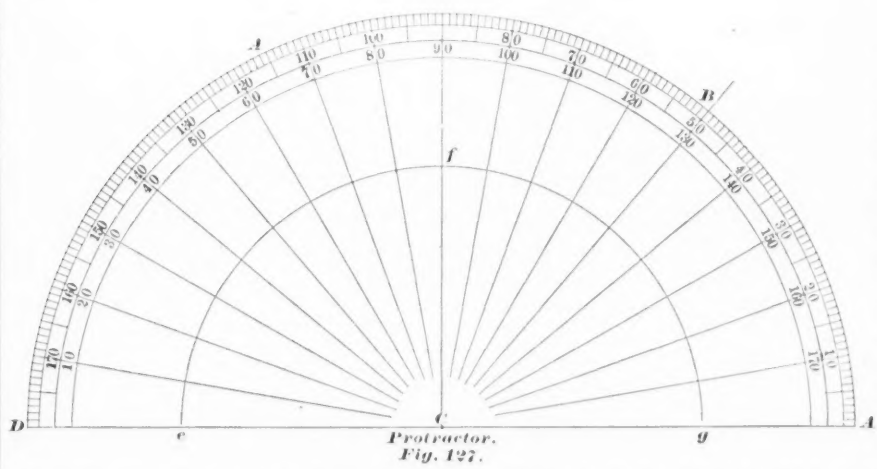


Fig. 126.



Protractor.
Fig. 127.

Fig. 127. Place the protractor in a position in which its center *C* will lie on the vertex *C* of the given angle, and the diameter *D A* coincide with the side *C A* of the same angle; then the number of degrees on the protractor, which lie between the lines *A C* and *B C*, will be the number of degrees which the angle *B C A* contains; in the example before us we see that the angle *B C A* contains 50 degrees, and such an angle is called an angle of 50 degrees.

171. Now let it be required to lay off an angle of 50 degrees.

Fig. 127. Draw one of the sides as *C A* of the angle in the required position, and on it mark off a point to represent the vertex *C* of the required angle. Place the protractor with its center *C* on the vertex of the angle, and the diameter *D A* coinciding with the side *C A*. Next lay off on the paper the point at which the line marked 50 on the protractor intersects the circumference of the same, then lay the protractor aside; join the point just laid off, and the vertex *C*, by a straight line; the angle thus formed will be the required angle.

172. Large or small protractors can be bought; and by a little reflection it will be seen that the length of the diameter, or, in other words, the size of the protractor, will not interfere with the correct indication or reading of the number of degrees contained in an angle. Thus, for instance, in measuring the angle *B C A*, Fig. 127, a small protractor, as shown by the semi-circumference *e f g*, will indicate the same number of degrees contained in the given angle as is indicated by the larger protractor *D H A;* or, in short, both protractors show that the angle *B C A* contains fifty degrees. A protractor of a semi-circular form, similar to that shown in Fig. 127, about eight inches in diameter, divided into degrees and half degrees, and made of horn, will give general satisfaction, and will meet all the demands which may arise in these lessons.

173. *Irregular Curves.*—Figs. 128 and 129. So far we have had to draw circular arcs only; but in our progress we shall have to draw arcs which are not circular. They will be elliptical and otherwise. For this purpose we use the irregular curves.

These curves are made of pearwood, or hard rubber. We prefer curves made of thin pearwood; and our experience leads us to believe that two curves similar in form to those shown in Figs. 128 and 129, and about eight or ten inches long, will meet almost all the requirements of ordinary machine drawing.

As will hereafter be seen, when these curves are to be used, points of the arc to be drawn are given. Now, in order to draw an arc with the aid of the irregular curve, that portion of the curve must be applied which will touch at least three of the given points of the required arc. If the curve will touch more than three points at one time, so much the better; always endeavor to take in at one time as many points as possible. Then draw along the edge of the curve the required arc. If this does not complete the arc, apply another portion of the curve which will touch the remaining points, or at least three of the remaining points, in addition to the last point of the portion of the arc already drawn; and in this manner, by applying successively such portions of the curve as are suitable, arcs of variable curvature can be drawn.

174. Spring Dividers, Figs. 130, 131. In this instrument the handle is made of German silver or ivory, all the rest is made of steel. The construction of this instrument is such, that when the nut on the screw *A* is screwed outward, the needle points will spring further apart. The screw *A* is pivoted to one leg and passed through a slot in the other, so that the screw can adapt itself to the various positions of the legs. The thread on the screw *A* is very fine, so that a great delicacy of adjustment is obtained.

Whenever the spring dividers will take in a desired dimension it is best to use these in place of the plain dividers, such as shown in Figs. 62 and 63, because the former possess a firmness and delicacy of adjustment, which the latter do not possess.

175. Spring Bow Pencil, Figs. 132 and 133. The only difference between this instrument and the spring dividers is, that the former instead of having two adjustable needle points like the latter, has one adjustable needle point and a pencil holder; otherwise the two instruments are alike. The spring bow pencil, on account of its firmness is almost indispensable for accurately describing small circles. It may appear to the student that with the compasses shown in Fig. 53, any circle, large or small, might be drawn, but he will find, that, by attempting to draw with these compasses a small circle, say about $\frac{1}{8}$ of an inch in diameter, the resistance of the paper—even when the paper is comparatively smooth—is sufficient to spring the pencil point out of place to an amount which, even if it is equal to only a hair's breadth, is large in proportion to the radius of the circle, and is enough to cause mortification in beholding the bad work.

With a spring bow pencil equal in size to that illustrated, circles about $1\frac{1}{2}$ inch in diameter can be drawn ; larger circles are drawn with the compasses shown in Fig. 53.

176. Spring Bow Pen, Figs. 134 and 135. This instrument is made of the same material as that used for the spring dividers ; and in principle of construction these are alike. A further description is unnecessary as the illustration is sufficiently clear. In regard to the use of the bow pen, it may be said, that its range for drawing circles of large diameters is limited, because in inking comparatively large circles the position of the pen will be too slanting, and uneven or broken ink lines will be the result. But for inking circles of small diameter, the bow pen is indispensable, because with these a good junction of the circumference can always be obtained, and thus prevent the marring and disfiguring of otherwise fine drawings. The remarks relating to the straight pen, and given in Art. 82 are also applicable to the spring bow pen.

The illustrations of the spring dividers, bow pencil and bow pen are full size, and are about the size of instruments which the student should select.

The *Mail and Express* devotes space to a description of hoisting the cars laden with coal at Weehawken. Speaking of unhooking from the moving cable, it says of the man who does this: "On any day, but more particularly when it is racing fast, his chances are ten for one for slipping and falling in under the fast moving car." As a good many cars are unhooked in a day the only inference from this is that there must be a small army killed in that time. We were always of the opinion that the whole operation of transferring coal cars at Weehawken was done with very slight regard for life and limb, but are not prepared to believe it to be quite so dangerous work as the *Mail and Express* paints it.

Sargent's Valve Gear for Steam Engines.

The accompanying engravings show a new cam valve gear, designed by J. W. Sargent, chief draftsman for the Dickson Manufacturing Company, Scranton, Pa. By this gear the throw of the slide valve is divided into two separate parts, instead of one complete motion, as with an eccentric.

The first part of the throw from full opening moves the valve so that it laps the port about $\frac{5}{16}$ inch, thus cutting off the steam, but not choking the exhaust at the other end of the cylinder. This movement is actuated by the cut-off cam, which is loose on the shaft, with its angular advance controlled by the governor. This cut-off motion may occur any time from zero to $\frac{3}{4}$ of the stroke of the engine, according to the position of the governor.

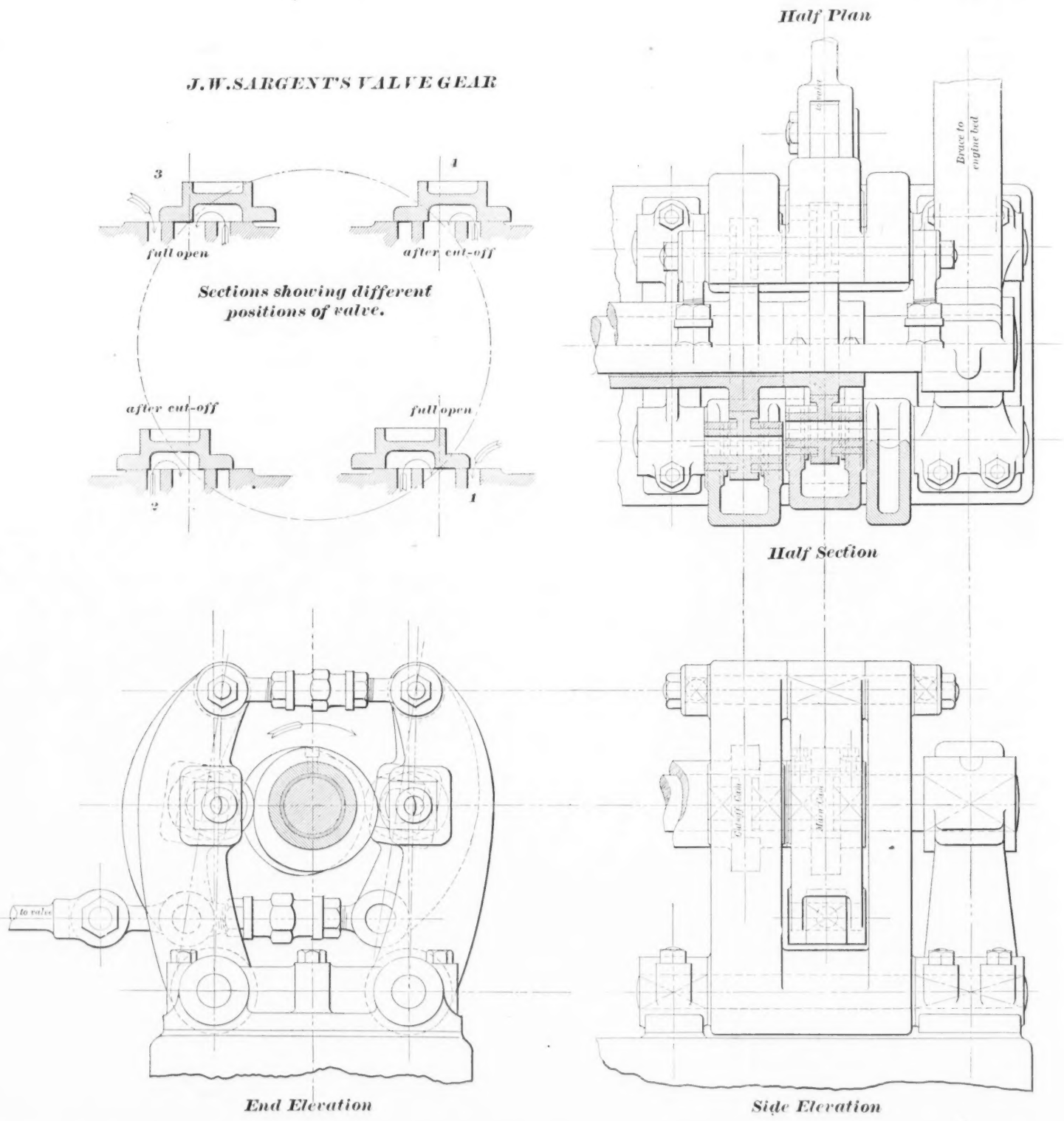
The second part of the valve motion is actuated by the main cam, which is keyed to the shaft, thus giving a constant compression, release and admission. The sections of the valves show the positions clearly.

The valve gear, as here shown on a side shaft, with a hydraulic governor to control the cut-off cam, is being applied to an 800 horse-power compound engine now building by the Dickson Manufacturing Company.

For general use the gear is intended to be placed directly on the main shaft next the pillow block, the cut-off cam to be controlled by a fly-wheel governor; the connection, by a rod and single rocker, to be made to a light working valve on the side or bottom of the cylinder.

This gear, operating a single valve, is said to give an indicator card equal to the best drop cut-off engines, and admits of a very much higher rotative speed.

The inventor, we understand, would make arrangements with engine-builders to use this valve gear.



Unions and Wages.

The New York State Commissioner of Labor Statistics, C. F. Peck, takes the view that labor organizations raise the rate of wages by means of strikes, or preparations for strikes, very much as coal companies raise the price of coal, by combining and striking against the public. He refers, of course, to industries in general. We know that it is very seldom that a strike, or threats of a strike, raise wages in a machine shop. The advances are almost always voluntary. Mr. Peck, in his annual report, says:

"There seems to be but little doubt that men engaged in the building trades have been greatly benefited by the boom in that industry; but it is equally true that they would not have shared these benefits had they not went on strike to secure them, since the returns show frequent strikes in this line.

"The increase in buildings can be traced to several causes; the withdrawal of capital from other channels; the extension of the elevated railroad system in New York and Brooklyn; the cheapening of rates on these roads, and the greatly increased facilities of transportation on railroads that lead out to the suburbs in the larger cities in the State; and, moreover, the general prosperity of the country. Notwithstanding all these favorable combinations, however, it is doubtful whether the working men would have shared in the benefits of this prosperity, had it not been for their unions and labor organizations. No small part of these benefits is due, moreover, to strikes or to threatened strikes. If they were not organized and prepared to strike, employers would have reaped all the advantages of the revival in trade. At least this is a fair presumption, and it is based upon past events and the almost general conviction of the workers themselves.

"It would be a subject of sincere congratulation if the Bureau could record the fact that employers had voluntarily increased wages, but I regret exceedingly that the cases are so few and so far between, and so slight withal, that if there be such they have not risen to the surface. There is not a single case reported to this Bureau, in which an employer had advanced the rate of wages before the epidemic of strikes set in. The rare cases of profit sharing and kindred attempts of employers to deal fairly and justly with their employes took place in the latter part of the summer and early fall, whereas the striking began early in the spring. All evidence goes to show that employes will not be given full wages, or rather wages more in keeping with the prosperity consequent upon a revival in business, unless they are forced. How can they be forced? Only by organization on the part of their employes. These latter would have to go with a short, perhaps a shorter stint, unless they could show that they were able to hold out, and so, perhaps, prevent the revival, unless they also were given their share in the general prosperity. Their only method of finding out the true condition of the labor market is by assembling together and discussing their chances. The conclusion is inevitable. Having thus come together and opened a discussion (and the result shows that business has improved) and who so competent to pass upon this as the workingmen, then the laborers will come by their own either through voluntary concession or from dread of the possible strike for an advance.

"Frequently other trades than those that were affected by the strike have shared in the advance secured. The advantages of a strike cannot be calculated simply upon its cost or upon the gain in wages; moreover the worst paid, and those who have no union at all, share in the gains.

"It is no time for the optimist to assure the unionists that wages will surely rise without the threatened strike. The fact that the men are organized and prepared to go out in case their reasonable request is denied, has generally resulted in the advance being given; and beyond all question more promptly than would otherwise be the case."

The latest motor, at this writing, is to be worked entirely from the natural expansion and contraction of metals. It may require more metal than the sanguine inventor dreams of, but as he goes right to the sun for heat he will be independent of coal mines. Moreover he is reasonably sure to have the entire field to himself.

Width, Strain and Working Adhesion of Belts.

The Page Belting Company, Concord, N. H., have issued a very neat and well prepared pamphlet, embodying besides a telegraph cipher code and information about the belting they manufacture, much that is desirable for users of belts to know. We quote from the pamphlet:

"The width of belt needed depends on three conditions: 1st, the tension of the belt; 2d, the size of the smaller pulley and the proportion of the surface touched by the belt; 3d, the speed of the belt.

"The average strain under which leather will break has been found by many experiments with various good tannages to be 3,200 pounds per square inch of cross section. A very nice quality of leather will sustain a somewhat greater strain. In use on the pulleys, belts should not be subjected to a greater strain than one-eleventh their tensile strength, or about 290 pounds to the square inch of cross section. This will be 55 pounds average strain for every inch in width of single belt three-sixteenths inch thick. The strain allowed for all widths of belting,—single, light double, and heavy double,—is in direct proportion to the thickness of the belt. This is the safe limit; for, if a greater strain is attempted, the belt is likely to be overworked, in which case the result will be an undue amount of stretching, tearing out at the lace or hook holes, and damage to the joints. When the belt is in motion the strain on the working side will be greater than on

the slack side; and the average strain will be one-half the aggregate of both sides.

"The working adhesion of a belt to the pulley will be in proportion both to the number of square inches of belt contact with the surface of the smaller pulley, and also to the arc of the circumference of the pulley touched by the belt. This adhesion forms the basis of all right calculation in ascertaining the width of belt necessary to transmit a given horse-power. A single belt, three-sixteenths inch thick, subjected to the strain we have given as a safe rule—55 pounds per inch inch in width—when touching one-half of the circumference of a turned iron pulley, will adhere one-half pound per square inch of the surface contact; while if it be a leather-covered pulley, the belt will adhere two-thirds of a pound per square inch of contact. If the belt touches but one quarter of the circumference of the pulley, the adhesion is only one-quarter pound to the square inch of contact with the iron pulley, and one-third pound per square inch on the leather-covered pulley.

"The adhesion one inch in width of the belt has on the pulley is the number of pounds which each inch in width of belt is capable of raising or transmitting. Multiplying this by the velocity of the belt in feet per minute will give the total number of pounds each inch in width will raise or transmit one foot per minute. Now multiply 33,000, the number of pounds raised by one horse-power one foot per minute, by the horse-power to be transmitted, and divide this product by the number of pounds which one inch in width will raise or transmit one foot per minute, and the quotient will be the width of the belt required."

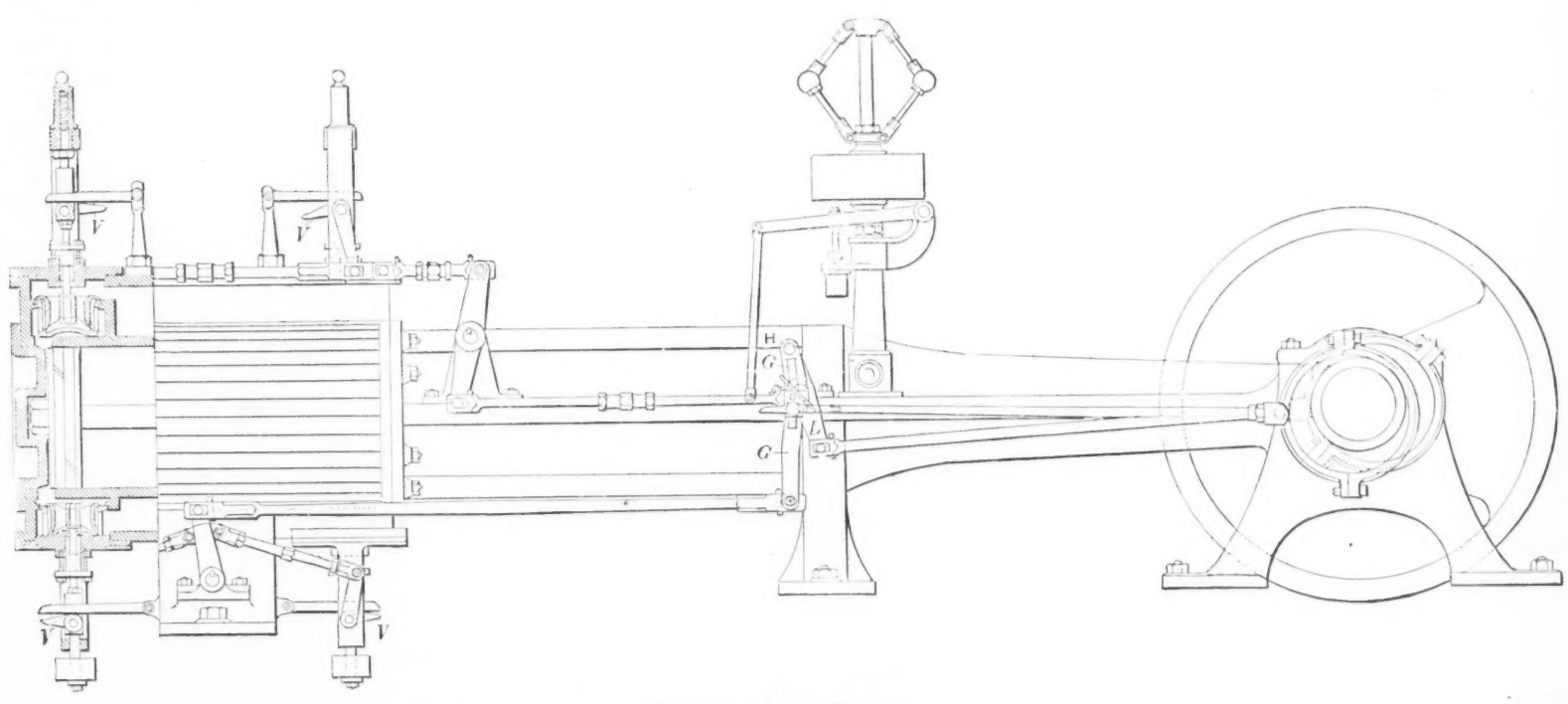
Automatic Steam Engine.

The line engraving shown herewith represents an automatic cut-off engine, designed by R. A. McLellan, assistant engineer of the Geary Street Cable Railroad, San Francisco. The principal feature is the means employed for steam distribution, in which there is some similarity to the well-known Sulzer engines. Two eccentrics are used, one of which is set with the crank, and the other 135° in advance. This arrangement gives quick admission, the motion being not unlike that brought about by the Corliss wrist plate. Poppet valves are used (although they are not indispensable). The exhaust valves are at the bottom, which drains the cylinder of water.

Although the position of the eccentric is such as would close the valves at one-half stroke if the motion was taken directly from it, by the prolongation of the vibrating link *G*, beyond its point of connection with the eccentric rod, a motion is obtained which is a resultant of that of both eccentrics, which is used for actuating the exhaust valves, opening them quickly, holding them for a time, and closing at about seven-eighths of the stroke.

The point of cut-off of the steam valves is determined by the position of the block in the vibrating link *G;* this is under control of the governor, which by the use of radial cam toes for lifting the valves, is slightly disturbed.

All four valves are lifted by radial cam toes acting upon lifting levers, the ends of which are forked, one side fitting into a slot in the square portion of the valve stem, which is not shown in the engraving.



AUTOMATIC STEAM ENGINE.

Some Notes on Steel.

BY JOHN COFFIN.

A prominent engineer once said: "Never ignore the whim of an old man. His reasoning may be false, but his facts may be true." I don't think there is any subject so fruitful of beliefs and fancies as steel and its treatment. We have all heard some surprising statements of how steel would behave under peculiar treatment. There is hardly a steel worker who has not his own peculiar ideas of just how steel should be forged and tempered, and according to his belief no other way will do; yet, of twenty men, no two will exactly agree. I believe it is a good plan to be very careful how we form our opinions and accept statements of facts. Yet I think we should not condemn the wildest fancies until we can maintain our position by actual experiments. I think most of the false beliefs in vogue have been caused by misinterpretations of the causes of the results sometimes reached.

Old men are apt to have more beliefs and fancies than young ones because they have had more time to collect them, and I would think very little of an old man who had not some positive ideas. I think, on the whole, I have been able to get some of the best practical advice from old men. So to my old man friend who may peruse these articles, I will say: If some things you read do not meet with your approval, if you think the experience of your life shows that I am wrong, remember these are only the conclusions I have reached—honestly given—and if you could show me that you were right, and I was wrong, I would frankly acknowledge my error. In fact, if we should meet, we would be fine friends.

If a man would tell me that a bar of steel would be better if it was held north and south while being forged, I would not believe him, but I would not contradict him until I had positively proved that he was mistaken.

The steel tools used in a machine shop may be considered as divided into two classes:

The tools made in the tool room, and those forged in the smith shop. We will consider the latter class first. The fire is of great importance. It is impossible to make a good tool in a poor fire. The very best fire is made of charcoal, and there are a few large shops in the country which use nothing else. If charcoal is used see that you use plenty of it to easily get a good even heat, and keep enough between the tuyere and the work to make the gases which surround the tool neutral. If a coal fire is used see that it is as free from sulphur as possible, as sulphur is very easily taken up by steel and is very injurious to it. Use a good bed of fire and do not heat in green coal. Heat evenly and not too rapidly. Do not be afraid to heat to a good mellow forging heat.

In forging you can hammer edgewise or flatwise, or you may upset it with impunity. I know this is contrary to a quite general belief, but when we remember that tool steel is, to all intents and purposes, non-fibrous, it can readily be seen that it makes very little difference in which direction it is hammered. The hammer work that is put on a tool in the smith shop cannot improve it much, for in most cases it has had hammer work enough in its manufacture, but there are cases where very large bars are used in which I think correct hammering may improve the steel somewhat. Be that as it may, it is essential that all hammer work should be intelligently done, for by poor hammering the steel may be very much injured.

The greatest source of evil is in hammering too cold. It is not an uncommon practice to take a good heat and commence vigorously with the fuller and sledge, but to put the finishing touches on at a very low, almost if not quite black heat, with a small hand hammer. I expect opposition when I say this is a bad practice.

No pening or light hammering of the surface should be done while the steel is at a low heat, as it tends to draw the surface and put bad interior strains in the metal, which may start weaknesses or actual internal cracks, and after the tool is broken in use the judg ment will be that it is poor steel. Any kind of hammering is bad when the steel gets too cold. Steel should always show some red in the diffused light of the shop, or it is too cold to hammer. I have never tried experiments to prove this point; but I feel certain, from the observations of others, which have been recited to me, and from published articles by prominent engineers, that there is something in it.

Mr. James H. Geer gave me the result of an experiment he tried on boiler plate, not long ago. A strip of steel boiler plate, two or three inches wide and half an inch thick, was heated on one end, red hot, the heat gradually differing down to a black. Then a number of bending tests were tried over the round corner of an anvil, commencing at the hot end, and extending back toward the cold end, until a point was reached at which it cracked, and broke quite easily by bending through a very slight angle. The bar was then cooled, and it bent double without a crack. Boiler makers who have flanged steel know that it is liable to crack at a certain temperature; and it is fair to suppose that high carbon steel would show this peculiarity in a more marked degree. I understand that an extended series of tests will be made in Berlin, Prussia, during the coming year, which will determine this point accurately.

I think I can hear some one say, "This is all wrong. I have not forged my own tools all my life without knowing better than that. See, I will prove it; I will take this cold chisel and forge it as you say. I will heat it to a good mellow forging heat, and I will not forge it cold, but finish it while it is yet red-hot, and then put it in the fire to let it soak a little and temper it. Then I will forge another one according to my notions. Take a low heat on it and hammer it down to a black heat. Compress it, you know; put a hammer temper in it. Then I will heat it up and temper it, as I did yours.

"Now take them and chip with them, and see if you are not convinced that mine is the best."

I don't need to chip with them, I know yours is best; but I think it is not because of your hammer tempering, but in spite of it; that is, you hammered it until it was so cold that its carbon was changed to non-hardening carbon, so that in heating to temper you got the chemical change of carbon, and refined it by tempering it, and not by hammering it, as you supposed.

If you had let my chisel cool, and then reheated it to temper, you would have found it not only as good, but better than yours. I firmly believe steel can be forged too cold, and it can also be heated too hot. I don't think any harm is done by heating it to an orange color in the dusk, but would not advise heating much hotter.

The next step, after you have your tool properly forged, is to let it cool until it is nearly or quite black. The object of this is to get the carbon in the non-hardening form so as to take advantage of that wonderful change which makes "refining by tempering" possible.

Bonus for Steady Workmen.

Our esteemed contemporary, the *Textile Record*, of Philadelphia, says:

Messrs. J. Morton Brown & Co., Norriton Mills, Norristown, Pa., have made the following liberal arrangements with their workmen: Each workman who has remained with the firm one year will receive an addition of five per cent. to his wages. Those who have remained nine months will receive a similar gift of four per cent., and six months three per cent., and for three months two per cent. of the total amount of wages. Employes leaving the establishment at any time on one week's notice will be entitled to the proportional percentage as above. Any one who shall be discharged for any cause will forfeit the increase in wages.

Man-Hole Gaskets.

The *Locomotive*, published by the Hartford Boiler Insurance Company, has the following interesting facts about man-hole gaskets:

"It is a mistake to suppose that because a man-hole or hand-hole plate is packed with a gasket made of rubber or other yielding material, that any sort of surface on the plate and frame or ring is good enough to insure a tight joint when the plate is screwed up, for it is far from being the case. A man-hole plate and ring should each have a flat, smooth surface, for then a joint can always be made perfectly tight with a minimum amount of screwing up on the plate. Where the frame is uneven it is quite possible to screw up a plate with sufficient force to crack the ring, and some very destructive explosions have occurred from this cause. This is especially apt to occur where the frame is one of the ordinary external kind, for then the weakest part of the frame, owing to the convexity of the shell, is exactly where the greatest strain from steam pressure occurs, and as such frames are generally constructed they are altogether too light to give a proper margin of strength. It should not be forgotten that the cutting out of the shell on top for a man-hole weakens it very much, and the man-hole frame should be strong enough to restore the full amount of strength thus lost. This is best fulfilled by an internal frame, for although the internal frame is much more inconvenient for entering the boiler than the external one, its strongest part comes just where the greatest amount of strength is needed, and it should always be used on boilers over thirty-six inches in diameter.

"When a joint supposed to be well packed leaks when steam is raised, excessive tightening up of the plate should not be resorted to; the pressure should be relieved, the plate removed, and the joint examined to discover the cause of the trouble.

"Hand-holes, although they require no strengthening ring to compensate for the loss of material where they are cut out, should, nevertheless, be very carefully made. Especial attention should be given to making a smooth seat on the interior surface for the gasket to rest against. This is, of course, an easy matter to attend to in new work; but, as often happens, where a hand-hole is cut in the back head of an old boiler, and the iron is laminated or of an inferior quality, it is not always an easy matter to make a good job. Under such circumstances it is sometimes nearly impossible to get a smooth seat. When this is the case it is very difficult to pack the joint so that it shall be tight with the ordinary rubber gaskets found in the market. Unless it is tight, corrosion very soon completes the bad job already begun, and in many cases a patch on the head has been found necessary. All this may be avoided by the exercise of care and a choice of suitable material for packing.

"The choice of a material for man-hole gaskets cannot be too carefully made. The material should be yielding, elastic, tough, and these qualities should not be very much affected by the temperature of steam at ordinary pressures. It should be yielding, because this property enables it to adapt itself to any trifling inequalities of the seat or surface of the plate, thereby insuring a tight joint with a minimum of trouble. It should be elastic to enable the gasket to accommodate itself to slightly different sizes and shapes of man-holes of the same nominal size. It should be tough and strong, as this is most important to prevent serious accident, and if it is affected but slightly by a temperature of, say, 350° F., a gasket may, if care be exercised, be used repeatedly, which is quite an important item when there are several boilers and the water is so bad as to necessitate frequent opening for cleaning purposes. Such gaskets can be procured without much trouble; but, to tell the truth, those lacking most, if not all, of the above desirable qualities are much more readily obtained. We have before us, as we write, a portion of a gasket which came very near causing serious trouble, a short time since. Owing to its weak and incompressible nature a portion of one of the man-hole gaskets blew out, and the shock was so great when it let go, that all the seams of the shell were so sprung that it was necessary to calk them, and the tubes were loosened so that they had to be rolled before the boiler could be used again. The boiler was an excellent one, or the probability is that it would have been ruptured and an explosion would have resulted from the shock. It is very likely that many explosions have resulted from this cause alone."

Corrugated Copper Gasket.

This gasket, one form of which is shown in the illustration, is designed for use in all connections for steam, air gas and water, including cylinder heads, steam chests, etc.

It is made of thin copper, corrugated, thus getting the spring of the metal to assist in making the joint.

It is not affected by heat or pressure, and will not blow out, and carries on its face the evidence of utility. It has been in use some time, and has demonstrated its adaptability to the purpose. It is made elliptical or rectangular as well as round, by the United States Mineral Wool Co., 22 Cortlandt St., N.Y.

Where a Coal Famine is Wanted.

"Comstockers would be delighted to be afflicted with such a coal famine as that of which they are now so loudly complaining in New York—a famine during the prevalence of which coal could be bought for $8 a ton. Here common Rocky Mountain coal brings $20 a ton and Scotch splint (from British Columbia) sells at $22.50. Could our people get anthracite at $8 a ton they would keep every stove red-hot; would probably set the town on fire in less than a week. The coal for which we pay $20 goes past us over the mountains by the Central Pacific and is sold at $8 a ton, after being carried all the way to San Francisco."—*Salt Lake Tribune.*

The above would seem to indicate that there was room for railroad commissioners to get in their work. Railroads in this country will have to cease their absurd discriminations in favor of a privileged few, or submit to inevitable government censorship. "Whom the gods would destroy they first make mad."

Little Things in a Foundry.

BY DAVID SPENCE.

A man comes in the foundry with one little pattern and wants 200 pieces in two days. The foreman says they cannot be got out in that time with one pattern. He can very readily make duplicate patterns by casting from this single pattern, using half block tin and half zinc. They will be nice and smooth, and the same size as pattern. Do not take the pieces out of the sand mould until they are quite cold. You will find it the easiest broken of anything you are likely to see, while hot.

Sometimes a man has an iron pattern to fit up, and finds some of the corners so hard that he cannot touch them with a file. If he will heat these thin parts to a cherry-red, then sprinkle on pulverized brimstone and let it remain till cold he will find that he can drill or file these parts.

You are pouring nice fine castings on the bench, which have to be finished, and would like two or three pieces for another purpose that will be harder. Set your ladle down while you go and change some weights on the floor. By that time the iron is dull, and the pieces you pour are a good deal harder than the first.

Wrought-iron skimmers without clay wash are bad things in a foundry. The bench moulder has some small pulleys to make, which must be finished. When he comes to pour he thinks the iron is too hot. He gets a wrought iron skimmer and stirs it around in his ladle till he has melted off about three inches. The results are that when these pulleys are turned there are places that cannot be touched with a tool. This all comes from using the wrought-iron skimmer without its being clay washed and dried.

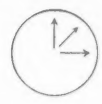
In answer to J. H. Holmgreen, if he will tin the small wrought-iron pieces he will not be troubled with their getting loose.

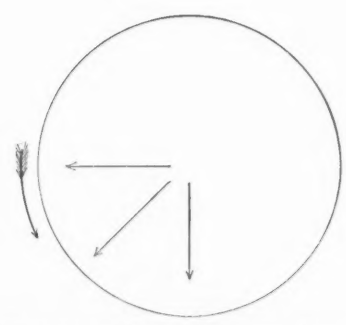
LETTERS FROM PRACTICAL MEN.

Strains on Shaft Journals and Crank Pins—Heating Cars.

Editor American Machinist:

The main journal of a Corliss engine 30″x60″, running at 56 revolutions, steam pressure 51 pounds, vacuum 27″, always warmed the most on one side and that where the weight came on it when it was standing still. The journal is 15″ diameter and 30″ long. The question was brought up in an engineers' association as to the cause. One of the members, who for a number of years had been in a shop where a great deal of repairing was done, drew two circles on the blackboard representing the shaft and pin as represented in the cut. There are two kinds of strains to cause friction and wear; one from the weight or bearing down strain and the other from work pushing sideways, as represented by arrows. The real strain, however, will be between the two in direction of the





middle arrow, which will be some above half way between the two, and the wear on the pin will be directly opposite, and this was the condition they found all the shafts and pins that came for repairs, and the points named should heat the most. The bearing mentioned rested on that side when standing still, and another engine with journal nearly as large showed the same thing. Suppose engineers examine their main journals and see if this is not correct. There are monstrosities in nature like an eight-legged sheep, four-legged hen, two-headed girl, etc. Didn't Mr. Rice strike a mechanical monstrosity when he found a crank-pin that was worn more on one side from jerking the reciprocating parts back and forth, than the other side from doing all the work of driving the engine?

About the plan for heating cars by steam to save life, suppose in case of accident the steam pipes in the cars became broken and the car filled with scalding steam, it might prove as fatal as fire. Because of the demand for more luxurious cars and faster time, locomotives have about all they can do now without heating the train, so that if steam were used there would have to be an extra boiler, which might be put in the baggage car. Wouldn't it be better in such a case to put in a radiator close by the boiler and a small motor, and blow hot or warm air into the cars? A cold car could be heated much quicker and no danger from roasting in case of smash-up.

Waterbury, Conn. W. E. CRANE.

Grinding Scrapers.

Editor American Machinist:

Carelessness in grinding scrapers don't pay. One man will rush up to the stone, jam his scraper against it for a few seconds, and then be off again without even glancing at the tool's edge or troubling himself about it; some rub it over the top; others grind at the front of the stone, some at the back. There is but one way to sharpen flat scrapers correctly for use on plane surfaces. If they are made like Fig. 1 one edge will have too much rake and the other worse than none. The lower edge will soon fail because it is too acute; and the top one will stand no duty whatever. The way shown in Fig. 2 is a pet conceit with many men, yet think that it cannot compare with Fig. 3, the correct method. By grinding a scraper to as near the curve of the stone as possible, we obtain two cutting edges, each of which has the same rake and will give equal service. Use the side of the stone running towards you, and smooth the flat side of the scraper on the other. By this means will be obtained a tool unsurpassed for use on general work in any metal.

Fig. 1

Fig. 2

Fig. 3

Wood is poor material for the centers used in laying out work. If it gets the least bit small in the making you have two alternatives, one about as disagreeable as the other. They are to stick a chip in back of the center or make a new one. The tin diamonds used with them often occasion much trouble by becoming loose and moving at a critical moment. Some time ago we found a large chunk of lead on the scrap heap. We cut it up into suitably sized lumps, melted it in a ladle and run it into a mould such as is used in making ordinary sticks of solder. Centers as needed can then be cut from the strips thus obtained. In fitting lead centers to a bore the correct size can easily be arrived at as the lead is readily drawn out by hammering or shortened by upsetting.

WM. Y. SCHMUCKER.

Annealing Steel.

Editor American Machinist:

Having read Mr. Goodyear's talks with mechanics about steel, etc., in the AMERICAN MACHINIST of January 29th, I wish to say: I agree with the "last man," that for annealing, steel should be heated slowly, carefully and no hotter than is proper for hardening, not only to preserve the quality of the steel, but for the best result in annealing.

It is my belief and experience that when steel is heated as above and slowly withdrawn from the fire, it is as soft as it can be made, and great length of time in cooling is no benefit.

When properly done the surface of the steel will be covered with a soft red oxide, something the color of brick-dust, whereas, if heated too hot, it will have a hard blue scale, indicating to me hardness. Boys, note this and try it.

We gave this a good demonstration the other day. We use considerable steel for making dies for twisting wire. We cut off the stock ($1\frac{1}{4}$″ round steel) in pieces about two feet long, and then drill and turn the dies, and cut off. The steel that we have heretofore used was soft enough to work without annealing, but what we have now is hard and gritty. Our man took the bars to the forge and heated them by putting one end in the fire and drawing through as it heated, leaving the last end to cool off in the fire.

Well, when he came to try them he found they were no softer than before, neither the end that was drawn through the fire, nor the one that was allowed to cool in it. He wanted to know what to do about it; he could make no headway in turning them. Upon looking at them I told him he had heated them too hot, that the surface should be red instead of blue. I took them to the fire and treated them the same as he had done, only

that I heated slower and lower. When they came out they were red all over, and soft all over.

R. Faries.

Lighting a Shop With Oil.

Editor American Machinist:

What can't be cured must be endured, so the old adage goes, and no doubt it is true, but it offers no excuse for not trying to improve our conditions. A good light is one very important factor, when correct work is required, but how often do we find the very poorest kind of a rig, or none at all in many country shops. The chief difficulty with all artificial illumination, so my experience goes, is to get it in just the most suitable position and hold it there safely and securely, but at the same time admit of easy change. Our lamp brackets, of which we have a number in use, were designed to fill the above conditions, and so far as I can see leave little to be desired, so long as we are obliged to use kerosene lamps. These brackets have a vertical range of 16", and a reach of 4′ 5″ with a range of adjustments to any point within that radius.

I give sketch of one complete, also section of one of the swing joints, and sketch of holder which is screwed to the window frame or wall. The holder, Fig, 1, is a simple casting projecting far enough to allow the lamp bracket to be folded close against the wall; it has a hole at its outer end, large enough to permit ½" pipe to slide freely.

The joint Fig. 2 is made by boring the threads out of the straight part of a ½" inch malleable T, and reaming the hole true, then having both ends squared up on an arbor; the end of elbow going next the T is squared true with the thread, then the plug which makes the swing is fitted to screw firmly in the elbow leaving the body an easy swinging fit in the T and without endwise motion.

Vertical adjustment of the whole bracket is obtained by sliding the vertical pipe through the hangers or holders Fig. 1, the weight of the bracket and lamp when half filled with oil being balanced by a weight, with cord, over a pulley fastened near the ceiling. The cord is attached to the bracket by means of a pipe cap drilled with hole of suitable size, the cord being knotted inside and the cap then screwed on. Care should be taken to place the holders truly vertical, the one over the other, otherwise the lamp will not stay when you leave it, but will swing towards the lowest point.

No fears need be entertained about the bracket not remaining at the desired height, owing to the difference in volume of oil in lamp, for the bracket will not run up even though the lamp be taken entirely out, the friction of the pulley and the clutch-like action of the holders when the bracket is extended, preventing it.

The lengths of the several parts are so proportioned as to admit of its being closely folded. Our pipe and fittings are all regular ½", except the length holding the lamp basket, which is ⅜", and has a ⅜" plain elbow on one end and a ⅜" to ⅛" elbow next the basket.

My patent has never been applied for.

Chas. S. Beach.

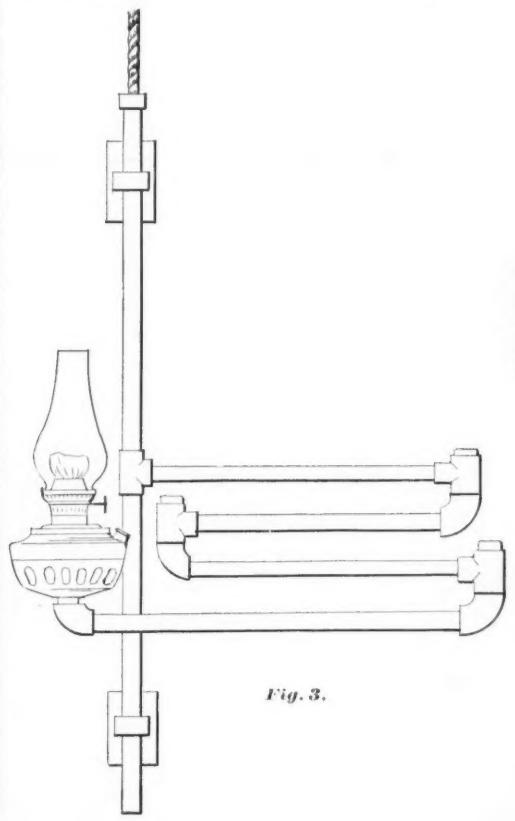


Fig. 3.

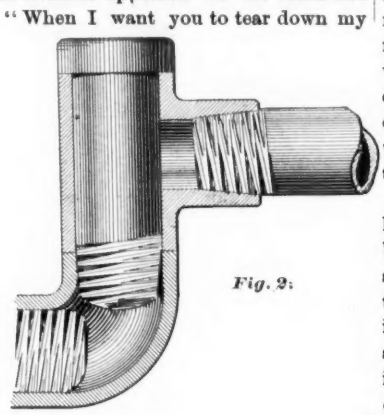
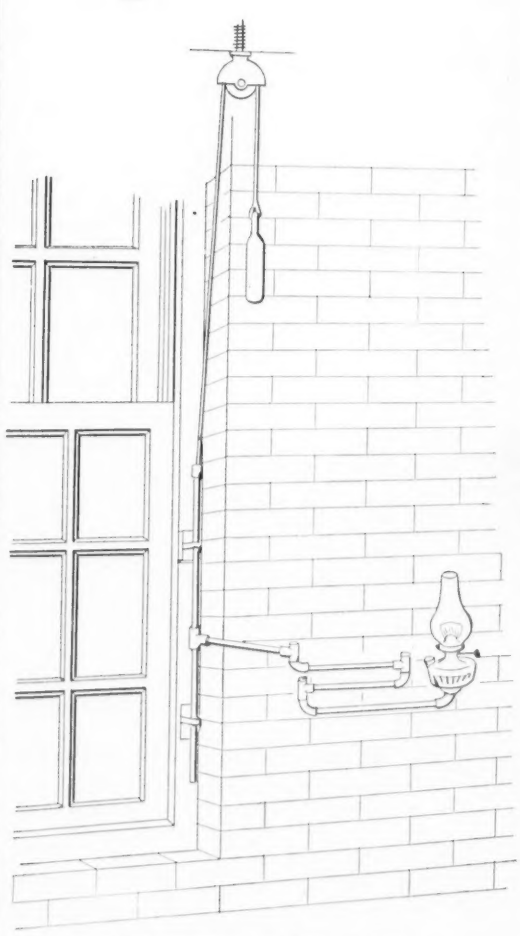


Fig. 2.

Fig. 1.



Arrangement of Shop Lamps.

The Love of Discovery.

By F. B. Masten.

The love of discovery is universal in human nature, and success depending largely upon the keenness of our perceptions, it is very humiliating to be overawed by outward circumstances, and have our own perceptions ignored; yet it is on these very conditions that we hire out to work for others, subject to the discretion of our employer.

The love of discovery is just as strong in workman as in employer, and the lack of discretion in letting men bring out the best there is in them tends to make men retire their ambition and become automatic; and then the employer wonders why his men take so little interest in their work.

The love of discovery does not seem wholly like curiosity. If we were to find a curious shell upon the seashore we would not exchange it for a much more curious one which our friend had bought. Our discovery of it would increase its value to us, while our curiosity would be satisfied in viewing the more curious shell. Seeing a live whale in a museum, and discovering one from the deck of a pleasure boat at sea produce very different emotions.

It is curiosity which impels the small boy to cut open his drum to learn what makes the noise; it is the love of discovery which a few years later makes him quarrel with his friend about who first discovered the house on fire.

"I found it first!" Who in his youth has not heard this exultant and defiant cry! And who, in riper years, has not seen the claimant near the verge of distraction in contention for the honor of original discovery!

Whether it was curiosity or the love of discovery which first led civilized people to these shores, certain it is that the love of discovery has been the leading impulse of their descendants, who now constitute the inventive Yankee nation.

Our discoveries often depend upon the keenness of our perceptions, and to insinuate by word, deed or look, that a person is lacking in perception, is an offense of high grade, and it is surprising to see what slight causes can be construed to imply this offense. This is why it is unsafe to offer assistance unasked. The object of your good will may think that you have been taking time to spy out his nakedness. Much depends upon the constitution of the man.

Once, in a part of the country where I was a stranger, I saw some cows and young cattle making sad havoc with the roasting ears in a fine field of corn. Seeing no quicker way to get them out, I let down the rail fence and drove them into the road. Just then an excited individual appeared on the scene and said: "When I want you to tear down my fences I will let you know." I said: "I hope I have done no damage in trying to save your corn." "You have nothing to do about my corn," said he. I asked if he took me for a cowboy. "No," said he, "I take you for a man who don't know enough to drive cattle out where they got in."

Realizing that I had offered services unasked, I took to the road; not in any great surprise either. That man knew where the cattle got in, and no doubt the fault was his, but he was in ill humor, and his habits of thought made it much easier to dwell upon my want of perception than to contemplate his own faults. I had seen such instances before, and I have seen them many times since; and generally there is a shadow of cause for saying that the innocent victim has gone beyond his jurisdiction, as I had done in this case.

Once, as the new foreman, I found the connecting rod brasses not well done, and the fault was laid to the bad condition of the shaper. Upon investigation I found it was the practice to cut brass with tools just like those for wrought iron. I gave the tools less clearance and no rake, and there was no more trouble.

The pulley lathe chattered badly. I gave less clearance to the tool and set it so as to pull instead of push against the work, and that was a great improvement. The planer would not give a water cut finish, because it was out of order, and the connecting rods were finished by hand. I made a tool and set it so there was no tendency to "hog in," but rather to push back and hold the cut steady, and then the planer would give a water fin sh.

These things and others were not all done in a day, but as they came along in the course of the work, and I thought I was giving entire satisfaction.

Two of the lathes bored very much tapering. When opportunity offered I trued one of them by the face-plate, and, finding the front box low, put a shim under it and then the lathe bored straight. When the work was favorable I began on the second lathe, but my employer coming along said he had seen enough of that sort of thing; he wanted the tools used as they were. Others had used them so and I could do the same. And this was the man who had told me that the tools were all in bad condition because he had not had the time to see to them himself.

I took no offense; I wanted to get over the rough places smoothly and make a success of my situation; but the rough spots increased rapidly. One day a drayman came to the machine door with a very large pattern, which, evidently, was intended for the foundry. Mr. E. had not yet returned from dinner, and the clerk in the office could give no advice about it, and so I sent the drayman to the foundry.

When Mr. E. returned, I told him what I had done, and he said he wanted that pattern brought right back to the machine shop. I attended to it, and placed the pattern on the machine shop floor, where it lay alone in state for about an hour, when Mr. E. appeared, with four men, who, each taking a corner of the pattern, marched decently and in order, following their leader toward the foundry. I made a discovery then—not a pleasing one. And this was the man who had bewailed the scarcity of men who could go ahead and do something without having to be told how every move should be made. He would not let men go ahead and do without his special orders. If they tried to do so, he regarded it as an interference with his prerogatives. His idea of superintending workmen was to make them to do differently from the way they had started to do. As for plans and specifications of work, none but he only knew parts and parcels, so that his will and his word might be law. I thought of the cattle in the corn field, and again I took to the road.

I have presented two rather violent types of that phase of human nature which likes to magnify its own discoveries and belittle the perceptions of others; but I once read in the American Machinist that extreme cases of error were most likely to attract the attention of the reformer.

Happily, other and better phases of human nature are usually found in charge of cornfields and machine shops.

I have in mind now a shop which is noted for its promptness in filling orders, the accuracy of its work and the volume of its business.

There, the first thing in order is to make drawings of the work, in plan, elevation, section and detail, and often there goes with the drawings a copy of specifications.

Everything is made as clear as possible, not only to prevent mistakes, but also to save the time of the workmen.

The work proceeds systematically; patterns, castings, and forgings are begun soon enough, and attended to closely enough, so that when the work comes to the machine shop it can be handled to advantage. The foreman does not have to spend his time in looking after plans and material, nor in changing men from one job to another for the sake of keeping them in work. He can see to the execution of the work, and have it of some credit to the shop when done. There is no rushing, pell-mell, lightning work about it, but every move counts.

The last time I was at these works the superintendent had ample time to make my visit entertaining and instructive. There was no hurry and confusion. Every man knew just what to do and was doing it. No man jumped into his work at sight of the superintendent, but all seemed glad of his presence. This superintendent is proud of his discoveries, and well he may be; he has discovered the art of letting men work.

William Lowe, a well-known boiler maker of Bridgeport, Conn., recently informed a representative of the American Machinist that he had used steel in the construction of boilers, extensively, for the past 15 years, and in that time did not know of a single instance of failure in service.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Pres't.
JACKSON BAILEY, Vice-Pres't.
LYCURGUS B. MOORE, Treas. and Sec'y.
96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

F. F. HEMENWAY, Mechanical Engineer.

The American News Company,
Publishers' Agents, New York.
The International News Company,
11 BOUVERIE STREET, Fleet Street, LONDON, ENG., will receive subscriptions for the AMERICAN MACHINIST, at 14/7 per annum, postage paid.

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NEW YORK, FEBRUARY 19, 1887.

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The Greatest Industrial Problem of the Time.

The great industrial problem is of world wide interest. It is the discovery and adoption of some plan to afford work for the unemployed. If in times when business is fairly active the number of idlers throughout the world grows larger, what must be expected, when in a few years another depression makes its appearance? It is well known that depressions last longer than periods of general prosperity in business. The mass of workmen who are employed may organize unions for mutual protection and their employers may do the same, but how shall the employed organize to protect themselves against the hordes of unemployed who must get work or starve? They cannot offer violence as a remedy, and it would be useless to organize the idlers into unions without an immediate prospect of work. It has been denied by some fine-sprung theorists who ventilate their views through the public press that the number of unemployed is large. We have recently seen the real facts developed in New York city and vicinity by an extensive strike of coal handlers and freight handlers. Thousands quit work simultaneously only to see other thousands step up to take their places at any rate of wages offered. Besides the local army of unemployed that marched upon the water front, thousands of recruits came in the city to swell the throng, anxious to work. It is admitted that no industrial depression exists now, but tens of thousands are undergoing enforced idleness. Those at work must support those who are crowded out of work. Advice to go West or advice to learn trades has no effect upon those who are destitute. It would be equally as good advice to tell them to build a railroad, or open some new coal mines. The problem exists West and South as well as East.

One year ago the car drivers and conductors of New York and other large cities were working fourteen to sixteen hours a day. They made a hard struggle, and in many cities do not now work more than twelve hours a day. They fought against the combined and entrenched powers of public corporations and syndicates, and they knew that just as many more men were idle and ready to take their places at the old schedules. Many more men are employed on street cars than there were a year ago. If the bill introduced into the New York State Legislature by Assemblyman Graham, who, as a street car employe, led the contest that brought shorter hours, becomes a law, ten hours will be the legal limit of a day's work on street car lines. This will require the employment of one additional man for every six now at work. Suppose steam railroads, coal mining companies, and other corporations, enjoying special privileges from the State were to shorten the days of labor by one or two hours, would it not go far towards settling the problem of idle labor? Corporate monopolies are the worst enemies of any plan to reduce hours of toil. If they were required to shorten the work-day, individual employers could, and probably would, follow with like reductions. We believe that no other remedy exists for getting rid of the growing army of enforced idlers, than cutting down the hours of daily labor.

Incidental Manufacturing Expenses.

The unproductive part of a machine business is something not generally comprehended except by those who have had considerable experience in paying the bills. It is always a large item in machine shop expenses. The inventor, who, by virtue of being a good mechanic, may be able to judge very accurately of the cost of material and the first cost of work required to build what he has devised is reasonably sure to underestimate the actual cost of production from failure to reckon cost quite essential to doing business, but which does not go directly into his machine. It costs so much to plane and bore and turn parts, but how much does it cost to keep ready to do this planing, boring and turning?

Mechanics who start in business for themselves are not apt to consider the cost of unproductive labor which they must employ at its full value until it strikes them some day, perhaps disastrously. Office help, drawing room expenses, helpers, engineers, firemen, salesmen, tool makers, all swell the expenses which must somehow be paid for from the work done.

Manufacturing concerns outside of machinery generally have large expenses of this kind. In one establishment we recently saw twenty-five to thirty machinists at work, their work being constant and adding all the expenses of a fair sized machine shop to the work of manufacturing. Connected with a machine shop fifteen or twenty draftsmen, high-priced help, may be working, and their wages must appear in the cost of production. These and kindred expenses cannot be avoided, and the wise man starting in business will try and set them down at full value in the beginning. Even then he will get them too low about nine times out of ten.

Boiler Explosions.

The explosion of five boilers at and near Pittsburgh in one day recently, emphasizes the fact that there is yet something lacking in the inspection of steam boilers, or in their care and management. While the boiler is the possible point of danger in and around a manufacturing plant, it is a curious fact that it generally receives less attention in the way of inspection and management than other parts, the failure of which would result in pecuniary loss only. The boiler is the *possible* point of danger, because the explosion of a steam boiler is always inexcusable. The shaft or machine may be allowed to go till it fails, and it is too often considered that the boiler may be used in the same way, only the boiler is not watched quite as carefully as the other, because it is not so conveniently done.

The tendency toward higher steam pressures is certain to increase the frequency of boiler explosions unless more carefully guarded against, because there is no tendency to reduce the diameter of shells, and the safe limit for thickness of sheets exposed to fire is already reached, and is sometimes exceeded. Boilers under careful, systematic inspection are allowed pressures that are dangerously high for those not under such inspection, and present practice as to pressure is dangerous in any case unless care and management are of the best kind.

The Iron Manufacturers Association of Pittsburgh have an annual contract with the Amalgamated Association of Iron Workers for the payment of wages on a sliding scale. The base price of iron has for some months been two cents a pound. For every tenth of a cent advance in selling price, the workmen are to receive an advance as specified in the scale. The Manufacturers Asssociation fix the selling price, and the workmen now declare that some of them are selling at two and a tenth cents, while refusing to allow an advance of wages.

The barb wire pool recently met and agreed unanimously to advance prices five to ten per cent. The pool will, it is said, "cooperate" (not combine or conspire) with the smooth wire manufacturers to curtail production, and throw a portion of the workmen out of employment, so as to maintain prices. The vice-president declared that the pool have been trying for four years to regulate production, "but now have the matter just where they want it." The pool is incorporated as the United Wire Company.

The foolish and dilatory policy of Congress in neglecting to provide a strong system of coast defenses is condemned on every hand. When mutterings of difficulty with a foreign power are heard people naturally begin to think seriously of our real strength in case of war. There is no doubt that an army could be raised and equipped even more rapidly than it was in 1861, but it is impossible to construct, on short notice, forts to resist modern heavy artillery as carried on European vessels of war. The demand for some action by Congress is urgent. The present Congress expires March 4th, but as most important legislation is usually crowded into the last few days we may hope for some provision to begin strong coast defenses without waiting until next year.

A reader writes to ask us whether those who procure the AMERICAN MACHINIST from newsdealers have the same privilege of making inquiries through our columns as those who send their subscription to us direct. We answer that every reader has the same privileges as every other reader so far as we are concerned. When we receive a question to be answered we never make research to discover where the inquirer procures the paper. It is sufficient evidence when anybody sends a question to be answered in print, that he is a reader of the paper.

Literary Notes.

The *Shoe and Leather Reporter Annual* for 1887 has just been issued. It is a directory of the tanners, boot and shoe manufacturers, dealers in boots and shoes, leather and findings, hides, skins and wool and shoe machinery of the United States, and the principal ones of the Canadas and Europe. It is published by the *Shoe and Leather Reporter*, 17 Spruce street, New York.

The Manufacturers' Review and Industrial Record of this city, which for many years has represented the textile manufacturing industry of this country, has improved its form by making the pages smaller. It now has 94 pages and is a model publication of its class. Supplements are published for dyers, designers and knit goods manufacturers.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(56) L. W., Fernandina, Fla., asks: Will you please let me know of something that will stick paper together immediately upon application? *A.*—We do not know of anything better than gum arabic and water. Perhaps by using some fluid more volatile than water—ether, for instance—the union would be a little quicker; this would be a matter of experiment.

(57) G. N. L. writes: Will you please recommend a good fluid for soldering on finished brass work? We have been using muriatic acid and zinc, but it runs through and eats off the lacquer and tarnishes the work. *A.*—Clean the joints thoroughly with emery cloth, then solder with a well-tinned iron, and use rosin, finely powdered, in place of muriatic acid. Use as little rosin as possible.

(58) M. S., Newark, N. J., asks: What is the power of a 4½-inch belt, tight; 16-inch pulley on main shaft running 150 revolutions, and 18-inch pulley on driven shaft, shafts 10 feet apart? Will a one-inch belt at 600 feet speed drive one horse-power? *A.*—Under the conditions named, 600 feet of one-inch belt should transmit one horse-power. The belt speed in the example given is 628 feet, and the power it would transmit is 4.7 horse-power, allowing 600 feet of one-inch belt to a horse-power.

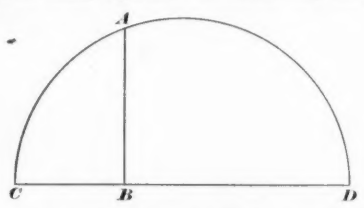
(59) E. F., Chatham, Ont., writes: I have seen an engine in which the piston moves about one-eighth of its stroke before steam is admitted, the cylinder head being so constructed as to follow it up to this point to prevent loss of steam. If an indicator diagram is taken from this engine, also from another engine taking steam at the beginning of stroke, both engines cutting off at the same point, are the two diagrams to be treated alike in calculating the power? You will notice that in the first instance steam is taken when the crank is in an advantageous position, while in the other the crank has but little leverage. *A.*—Treat the diagrams precisely alike in calculating the indicated power. The length of diagram represents, to scale, the stroke of piston, and from it you get the mean effective pressure for the whole stroke. It is true that the leverage of the crank is less during the first eighth of the stroke of piston than during the next eighth, but it is a longer time in passing the first eighth than the second. There is no loss of power in the crank. There would be a slight gain in friction in doing all the work with the crank nearer half stroke, but it amounts to but little.

(60) G. M., Orange, N. Y., asks: 1. What books would you advise a young machinist to study to help himself along? *A.*—Books on physics, strength of materials, etc. You cannot go astray in studying any good books relating to mechanics. 2. Which is the proper side of an unfinished nut to go to the outside? *A*—There is difference in practice in this respect. Generally the bevelled side is put outside.

(61) G. B., Moravia, N. Y.: 1. Your questions about electrical units you will comprehend the answers to by reading some elementary work on the subject. Write to a dealer in technical works for a catalogue. 2. Why is it that a 10-horse power throttling engine will govern better when used with a 20 horse-power boiler? *A.*—It will not, if the 10 horse-boiler is ample for the work. 3. We do not decide as to the comparative merits of different schools or colleges.

(62) John Sutton, Georgetown, Ont., asks: How can I case-harden small pieces of iron plate 3-16 inch thick to a depth of 1-16 inch? *A.*—Make a cast-iron box or pot with a cover. Put crushed bones, crushed charcoal and burnt leather scraps together with the articles to be case-hardened in the box; put on the cover and stop up around the joint with fire-clay. Bring the whole to a red heat. How long you should keep at this heat, to give the depth of hardening you require, is something you must determine experimentally; probably from 1½ hours to 2 hours—the longer the time the deeper the hardening. Remove the box from the fire, and dump the contents into clear cold water.

(63) C. H. F. writes: Will you please give a geometrical or graphic method of finding the mean proportional between two lines of unequal length. For instance, I have one line two inches long and another eight inches long; the mean proportional is four inches. How can I determine this without using figures? *A.*—Draw any straight



line, as *C D*; on this line lay off a distance *C B*, which is equal to the length of one of the given lines; from the point *B* lay off on the same line a distance *B D*, which is equal to the length of the other given line. Upon *C D* as a diameter describe a semi-circle *C A D*. Through the point *B* draw a line perpendicular to *C D*, cutting the circumference at the point *A*; then will *A B* be the required mean proportional.

(64) P. S., Boston, Mass., asks: 1. What speed should I expect in a boat 30 feet long; 4 feet beam; engine, 4″x4″; steam pressure, 250 pounds? *A.*—The speed depends upon a hundred things of which we can know nothing. Moreover, with all the facts at hand, it would be problematical. You ought to get 10 or 12 miles an hour. 2. Would not a 2-inch pipe running along the keel 25 feet make a good condenser for a compound engine, low-pressure cylinder 8 inches diameter? *A.*—A pipe 2½ inches diameter would be better, running around the stern and returning. Such condensers are sometimes used, but are not generally very satisfactory. 3. What advantage is gained by having one low-pressure cylinder larger than the other in triple expansion engines? *A.*—In triple expansion engines there is one low-pressure cylinder, one intermediate pressure cylinder, and one high-pressure cylinder, the steam passing from the high-pressure to the intermediate pressure cylinder, and from that cylinder to the low-pressure cylinder. Hence there is the same reason for making the low-pressure cylinder larger than the intermediate that there is for making the intermediate larger than the high-pressures 4. Would it be practicable to compress air to a pressure of 10,000 pounds per square inch, and use it in an engine? *A.*—Not in the present state of the arts.

(65) Student, New York, writes: 1. When a slide valve is directly connected to an eccentric, is the throw of the latter equal to the travel of the former? The books say it is, and define throw "the difference in measurement between the heavy and light side of the eccentric." If the definition is correct, why is it that an eccentric having a throw of three inches would cause the valve to move six inches? *A.*—If you will find the throw according to the definition you quote, you will see that a three-inch throw so found will move the valve three inches instead of six. The eccentricity of an eccentric is the distance of its axis of revolution (in common practice, the center of hole for shaft) from the center of its circumference. The throw is twice the eccentricity, and under the conditions named is equal to the travel of the valve, which is its extreme motion in one direction. This way of stating it is in accordance with the practice of most American mechanics. Unfortunately, however, it is not universal, some calling the eccentricity the throw; then the travel is twice the throw. 2. Please explain the formula for finding the required number of tubes for a boiler, and their relation to water and steam space, according to Mr. Lowe's articles on that subject? *A.*—We understand Mr. Lowe to recommend that the combined external area of all the tubes should be 5-35, or 1-7 the area of shell as nearly as practicable. This further explanation seems to be as clear as it can be made.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 169 William st., N.Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

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For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

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The Holly Manufacturing Company, of Lockport, N. Y., will send, on application, their pamphlet illustrating pumping machinery and reports of duty trials.

Practical Handbook on Pump Construction. Various kinds and materials to be made of for different purposes. By P. R. Bjorling. Nine plates, 12mo., $1.50. E. & F. N. Spon, publishers, 35 Murray street, New York.

Handbook on the Care of Boilers. 50c. Descriptive Circular and Catalogue of Books for Mechanical Engineers free on application; special terms to Mechanics' Libraries. E. & F. N. Spon, Publishers, 35 Murray st., New York.

St. John Improved Self-adjusting Cylinder Packing, for marine and stationary engines and locomotives; applicable to water, air, oil and ammonia pumps. For durability and minimum of friction, it is unexcelled. Send for pamphlet. Address, Balance Valve and Piston Packing Co., room 58, 280 Broadway, New York.

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"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2 post-paid. Published by John Wiley & Sons, 15 Astor Place, New York.

MANUFACTURES

The Knights of Labor are building a wagon factory at Caldwell, Kan.

The Benwood Iron Company, of Benwood, O., will build a new blast furnace.

Peoria, Ill., capitalists propose to start a $100,000 brewery at Little Rock, Ark.

The Baily Spring Company, of New London, Conn., will build a new factory.

An extensive addition will be built to the Eagle Cotton Mills at Woonsocket, R. I.

It is said there is a good prospect of a stove foundry being started at Somerset, Mass.

The Ohio and Mississippi Railway Company will erect machine shops in Washington, Ind.

Charles Kellogg and C. S. Maurice, of Athens, are interested in steel works to be built in that place.

A. H. Davenport, of East Cambridge, Mass., is building a four-story addition to his furniture factory.

The workmen in the Joliet (Ill.) Steel Works have received an increase of thirteen per cent. in wages.

The Abram Cox Stove Company, 144 North Second street, Philadelphia, will erect stove works in Lansdale, Pa.

The Chester Foundry and Machine Company will soon put a new machine shop in operation in Chester, Pa.

J. B. Mayo, of Foxcroft, Me., will erect a large woolen mill at Sangerville as soon as the snow is off the ground.

Taws & Hartman, of Philadelphia, will erect two large coke furnaces at Anniston, Ala. Work to commence in April.

It is reported that new malleable iron works will be built in Newburgh, O. Joseph Turney and John Beaves are interested.

The Crane Bros. Manufacturing Company, Chicago, elevators, have increased their capital stock from $1,000,000 to $1,500,000.

Subscriptions to the stock of the proposed furniture factory at Waldboro, Me., have progressed sufficiently to insure its success.

The A. Garrison Foundry Company, of Pittsburgh, has been incorporated. Capital stock, $650,000. Treasurer, Wm. Holmes.

The National Sugarine Refining Company, of Boston, has been incorporated. Capital stock, $10,000. The product is probably closely related to oleomargarine and soapine.

The Keene Manufacturing Company are refitting their skate manufactory at South Keene, N. H., so as to double the capacity of the works. New floors are being laid and new machinery put in.

The Chicago Co-operative Brewing Association, of Chicago, has been incorporated. Capital stock, $100,000. John D. Loud, George Greenbauer, E. A. Kadish, 287 Elm street, and others, corporators.

The Oswego Machine Screw Company, of Oswego, N. Y., has been incorporated. Capital stock, $13,000. James D. MacFarlane, John E. Sammons, Oswego, and Franklin H. Lancaster, Syracuse, corporators.

Jordan & Gottfried, 208 Canal street, New York, publish a colored steel tempering diagram on a chart to post up in the shop. This firm deals in supplies for machinists, engineers and manufacturers.

J. W. Russell, operating a foundry at West Middlesex, has made a proposition to move the plant to Hubbard, O., if given $500 to assist in erecting the necessary buildings. The proposition has been accepted.

The Union Bridge Company, of Buffalo, N. Y., has purchased the plant of the Elmira Iron and Steel Rolling Mill Company except Jay Gould's one-third. The price paid is said to be from $1,500,000 to $2,000,000.

A big enterprise is now being talked of in Portland, Me. It is a large door, sash and blind manufactory to employ 200 men, consume 1,000,000 feet lumber annually, and have annual aggregate production of $250,000.

A company, known as the Reading Screw Company, has been organized at Reading, Pa., with $50,000 capital. J. N. Jacquette, of Philadelphia and the present proprietors of the Reading Hardware Company are the stockholders.

The American Steel Scraper Company, Sidney, Ohio, have erected new works closely adjacent to the C. H. & D. and the C. C. C. & I. railroads, which are a considerable extension on their old premises. The main building is 126 feet long, having two wings of 100 feet each.

The Cleveland Rolling Mill Company are building a new blast furnace at their central works in Cleveland, O., and have contracted with Gordon, Strobel & Laureau for the erection of three Gordon hot-blast stoves for it. The capacity of the furnace will be about 175 tons a day.

Among the cities that are to have water-works or extensions of water-works, are Wahoo, Neb.; Salem, O.; Waco, Tex.; Bolivar, Mo.: Memphis, Tenn.; Pomeroy, W. Ter.; Chico, Cal.; Waterville, Me.; Texarkana, Ark., Centralia, Ill.; Malden, Mass.; Dover, N. J.; and Brooklyn, N. Y.

The foundry and machine shop of B. W. Grist & Co., Reading, Pa., with all the machinery, patterns and stock on hand, have been transferred to the Pennsylvania Iron Works, recently incorporated at that place. Messrs. B. W. Grist and Edwin A. Moore, who conducted the above establishment, are members of the new corporation.

A Montgomery, Ala., telegram of January 22d says: "Two hundred thousand dollars was subscribed in two hours to-day for the erection of a pipe foundry, the most complete in America, with 300 tons daily capacity. The land company, with a capital of $6,000,000, commences the sale of their city lots Monday next to the public."

Manufacturers are favoring the establishment of relief associations. Several New England employers have started them. One in Portland, Me., has a membership of 129. All persons whose wages are over $5 a week pay $1 fee and ten cents per week, which entitles a member in case of sickness to $5 per week until $25 has been drawn out, and $25 in case of death.

The Manchester Locomotive Works, of Manchester, N. H., have received an order from the Atchison, Topeka and Santa Fe Railroad, for thirty locomotives: one from the Boston and Lowell Railroad, for nine, four passenger engines and five freight, known as ten-wheelers; and smaller orders from the Minneapolis and St. Louis and Concord Railroads.—*Railway Review.*

Frank P. Sherry, of Lynn, has manufactured shoes on a practical co-operative plan for many years, and now concludes to do business under the co-operative system. Shares are now placed at $5 each, Sherry to furnish the capital required outside of what may be paid in. No member can belong to any organization which might interfere to the detriment of the new business.

A big building and business boom is ahead for Americus, Ga., soon. A company of Northern capitalists, with shrewd business men of the city, expect to build up machine shops for the manufacture of all kinds of iron and wooden implements, utensils, furniture, etc., from Wheatley's Variety Works, on the east side of Jackson street, to and beyond the American, Preston and Lumpkin Railroad.

The Oneida Steam Engine and Foundry Company, Oneida, N. Y, make the following announcement: "After the 1st of February the manufacture of chucks, under the several patents of John H. Westcott, will be continued by the Westcott Chuck Company, who will at that time succeed to the business of this corporation, and to whom all accounts must be paid. The present managers continue with the new company."

The *Industrial Gazette* says: "A company previously reported was organized at Birmingham January 20 to build what will prove the largest machine shop and foundry plant in the South. The capital is $100,000, and is all taken. The officers are R. W. Boland, president; Smith M. Evans, secretary; and C. W. White, general superintendent. Work on the plant is to begin at once. The products will be furnace, railway and other heavy castings."

At a meeting of the prominent business men of Youngstown, O., held on the 14th of January, an association for the commercial and industrial advancement of that city was formed. The association will endeavor to induce additional industries to locate there. The following committee was appointed to draft a constitution and by-laws: J. G. Butler, Jr., T. W. Sanderson, Robert McCurdy, A. B. Cornell, Dr. J. F. Wilson, Paul Wick and George M. McKelvy.

The St. Louis *Age of Steel* says: "Experiments with wrought-iron castings for edge tools are being carried on in the southern part of the city, and, apparently, with gratifying success, considering that the mixture has been scarcely up to the corrected formula. The castings are more nearly steel than iron, it is said, and are very malleable. The eye of a hatchet turned out by the new process has been repeatedly hammered down flat, and driven back to its original shape without the slightest injury to the metal. The experiments will be persisted in until the value of the process is fully demonstrated, if it can be, when heavier capital will take it up and work it."

New London is about to have a new industry added to its present manufacturing interests. It is the manufacture, by staining or stamping, of wall paper, and according to present calculations a force of 100 or more men will be employed when the works get under way. The site for a factory has already been selected on Winthrop's Neck. The building in contemplation will be 300x60 feet, with boiler and engine-house 60 feet square at one end. The building will be three stories in height, each story 11 feet, and it is understood that there will be as little delay as possible in commencing operations. The promoter of the enterprise is a New York gentleman of large experience in the business.—*Boston Commercial Bulletin.*

In a new illustrated pamphlet describing the business establishments of St. Paul, Minn., we find the following item. The four manufactories mentioned were all attracted to St. Paul by an article in the AMERICAN MACHINIST less than a year ago: "Beyond what is known properly as West St. Paul, and, perhaps, about half-way between the Robert Street Bridge and the stockyards, on the line of the Minnesota and Northwestern Railway, the Clark-Bryant Improvement Company began making improvements little more than a year ago They call their suburban locality South Park. Because of the favorable contour of the surface of the land and its situation relatively to the city, the stockyards, the railroad and the river, it has already developed into an important center of population, manufacture and trade. The new shops of the railway company are located here, and there are besides five manufacturing establishments erected and in course of erection upon the site; also quite a number of stores, one large hotel building which cost upwards of $10,000 and another of smaller size, and a score of handsome residences. These buildings are all new and substantial structures, several of them being of brick, and their aggregate cost must approximate closely to $150,000. What has been done here is all the work of a single year, and if the preparations now being made for next year's operations are carried out, as they probably will be, the improvements of 1887 will exceed those of the current season at least twofold. Four of the factories established—those of Holland & Thompson, Warner & Hough, the Dwane Iron Company, and the Watrous Engine Co.—are already in operation. That of Gordon & Ferguson will begin early in the spring, at which time a large addition will be made to that of Warner & Hough, for the manufacture of nuts and bolts, bridge material and general forging. In fact, South Park is assured of a prosperous future."

Machinists' Supplies and Iron.

NEW YORK, Feb. 8, 1887.

American Pig—Best brands No. 1 X Foundry have sold at $21.50 to $22.50; No. 2 X, $20 to $20.50; Grey Forge, $18.50 to $19.

Scotch Pig—Transactions are small, but prices are held fairly firm, at Coltness, $23.50 to $24; Gartsherrie, $22.50 to $23; Summerlee, $23.50; Eglinton, $21; Langloan, $22.50 to $23; Dalmellington, $21.50.

Copper—Lake is held at 11c.; other brands, 10c. to 10¼c.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Grinder and polisher on machine engine work wants job. Address M. G., AM. MACHINIST.

Good machine patternmaker wants situation. Address Patternmaker, Box 54, Branchville, Ct.

A machinist of large experience in general shop practice is open to an engagement. F. J. Masten, Belmont, N. Y.

Wanted—An experienced salesman in store dealing in pipe fittings and engineers' supplies. Address C. L. B., care letter carrier 14, Buffalo, N. Y.

Wanted—A man to run a 45" planer. Apply at once to Bridgeport Machine Tool Works, Bridgeport, Conn.

Wanted—Position with reliable firm mfg. steam pumping mchy.; exp., 15 yrs.' drawing and erecting for H. R. Worthington. Ad. Pumps, AM. MACH.

Wanted—Several first-class machinists for general job work; steady employment for the right kind of men. Address T. E. Krauss, Columbus, O.

Wanted — Mechanical draftsman. Address "Conly," office of AM. MACHINIST, stating amount and kind of experience had and compensation required.

Wanted—By an experienced patternmaker, situation as foreman patternmaker; good reference. Address S. K., AM. MACHINIST.

Wanted—Situation as foreman of iron foundry; accustomed to heavy work; 15 years' experience as foreman; work by the ton preferred. Address A. R., AM. MACHINIST.

Wanted—A situation by a first-class man as foundry foreman—one who understands the business in all its branches; 26 years' experience gas foreman. "Cupola," AM. MACHINIST.

Machinist, undoubted ability, desires permanent engagement, country preferred, where energy and study of employer's interest will be appreciated by advancement. Address Jig, AM. MACH.

Wanted—A good mechanical draftsman, who can do correct work and has had shop experience. Apply by Letter to A. K. Mansfield, *Mechanical Engineer*, 177 La Salle street, Chicago, Ill.

Patternmaker wanted; one accustomed to gas and steam fittings and valve work preferred; must be a first-class workman. Address Box 1358, New York City.

A thoroughly competent mechanical engineer, experienced in drafting and constructing all kinds of engines, boilers, mill work, general machinery, etc., and in estimating costs, desires an engagement. W. B. Y., AM. MACHINIST.

Middle-aged mechanical engineer, with a thorough, practical education, wants situation as superintendent or head draftsman with concern making machinery for gas works, or making printing press preferred. Address Box 8, AM. MACHINIST.

✢ MISCELLANEOUS WANTS. ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Crescent steel tube scrapers are unquestionably the best. Crescent Mfg. Co., Cleveland, Ohio.

Crescent boiler tube cutter, for setting new and removing old tubes. Crescent Mfg. Co., Cleveland, O.

Light mach'y of all kinds built at short notice Edmund Mills, 8 Dey st., Jersey City Heights, N. J.

For Sale—One 1⅛" Merriman bolt-cutter, one 20" swing, 12 ft. bed, engine lathe, both new. The McLagon Foundry Co., New Haven, Ct.

For Sale, Cheap—One new horizontal steam engine, 1½" dia. × 5" stroke, all complete. A. H. Jackson, Modena, Chester Co., Pa.

Castings for machine shops, water wheels, engines, pulp mills, saw mills and miscellaneous work Malone Foundry and Machine Co., Malone, New York.

Wanted—Self-acting machines for adjusting and clipping of iron wire in rings on bars. Address offers, with photographs, to R. M., 500, care of Haasenstein & Vogler, Frankfort-on-Main, Germany.

Wanted—A competent manager to take charge of and an interest of $10,000 in large and well-established foundry and machine works, conveniently located near the city of Troy. The works are well equipped and arranged for all kinds of work, particularly for heavy work; running steadily; work to be had to a full capacity, by a practical and energetic manager. All communications strictly confidential. Address J. H. Winslow & Co., Troy, New York.

For Sale — Valuable Manufacturing Property, centrally located in one of the largest Western States, with a well-established reputation for the goods of its manufacture, which consist of engines, boilers, saw and grist mill machinery, and kindred articles. Property all in first-class condition; tools and machinery in good order, and the works now running. Parties who mean business, and desire to engage in a profitable and well-established business of this character, can get full particulars by writing or applying in person to M. D. Wheeler, Stapleton, Staten Island, N. Y., or Manning, Maxwell & Moore, 111 and 113 Liberty st., New York.

✢ MISCELLANEOUS WANTS. ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

For Sale—Foundry, machine and boiler shops; brick buildings, modern tools, and doing good business; good reasons for selling. Address Sioux City Foundry and Machine Works, Sioux City, Ia.

Experimental and new machinery for special purposes built by contract from specifications and inventors' designs; ample facilities. Cohoes Iron Foundry and Machine Co., Cohoes, N. Y.

Special tools and machines for mfg. designed and built to order; mechanical and Patent Office drawings. Weston & Smith, Syracuse, N. Y.

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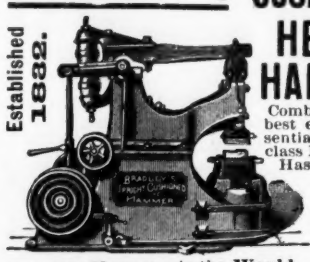

Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other **Hammer** in the **World.**

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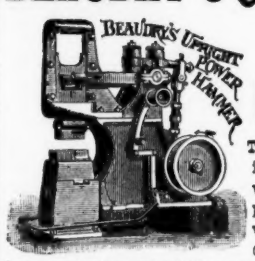

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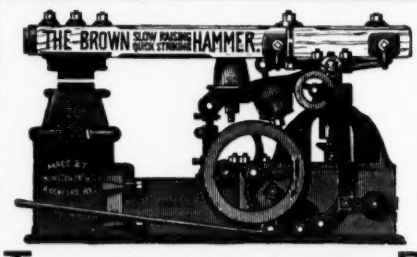

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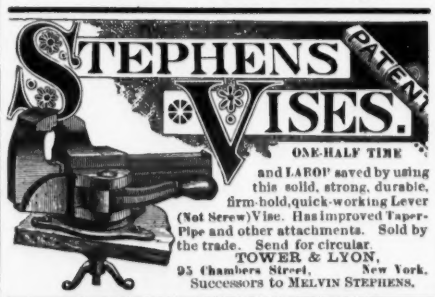

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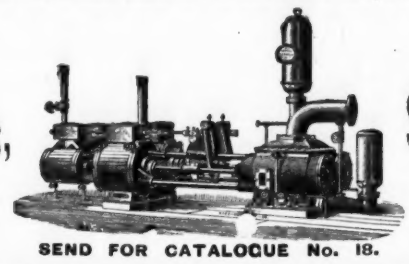

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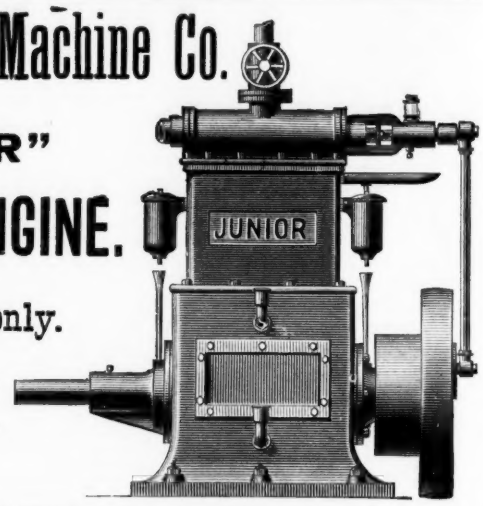

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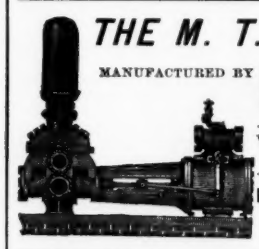

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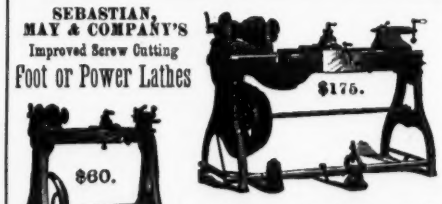

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20	"	"	8	"	"	compound	rest.	
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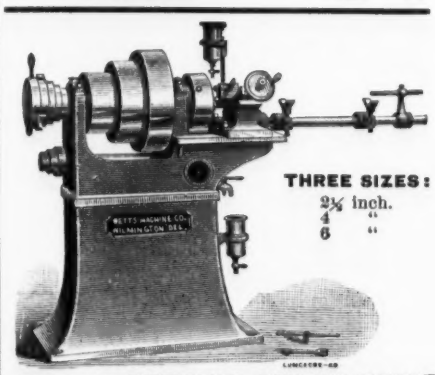

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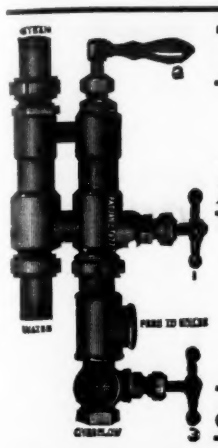

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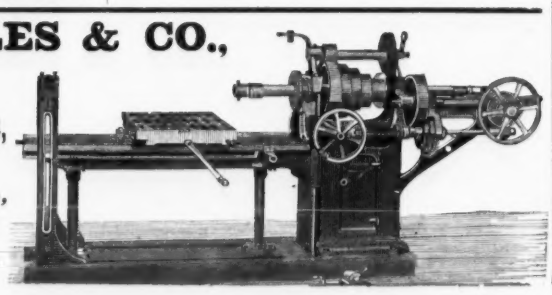

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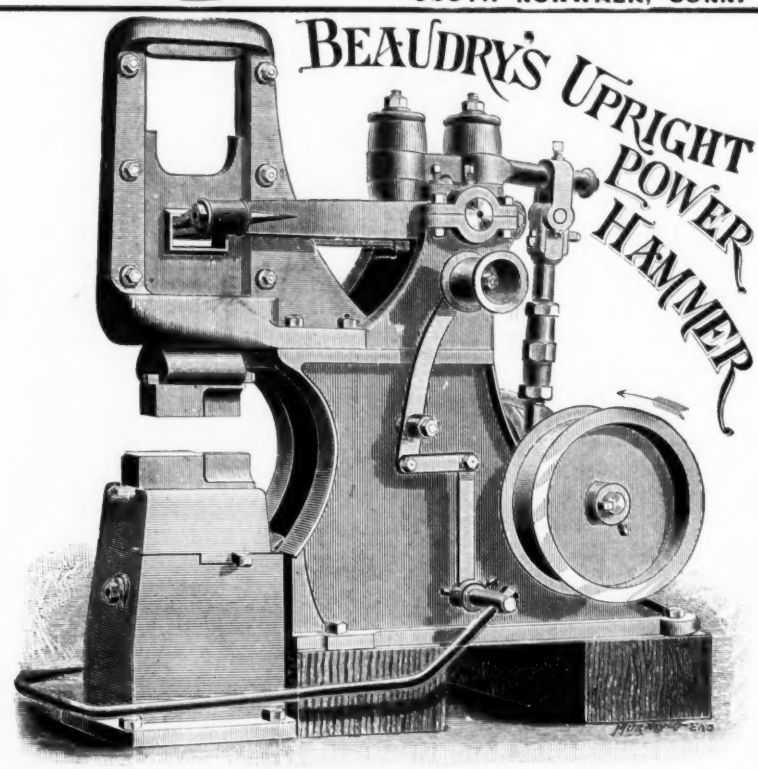

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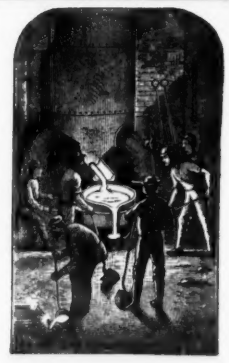

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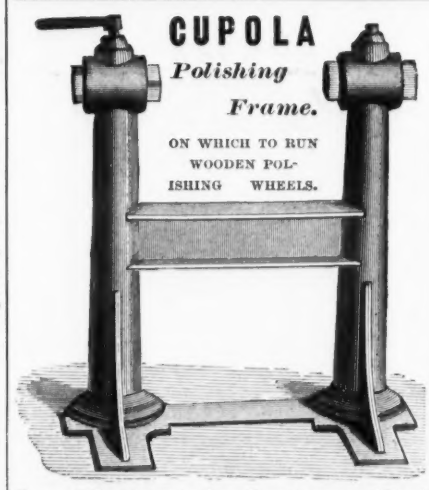

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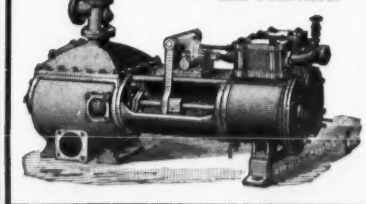

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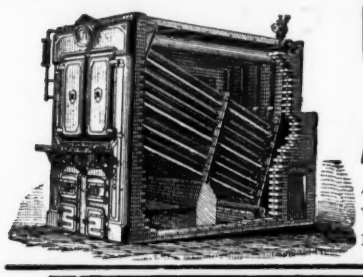
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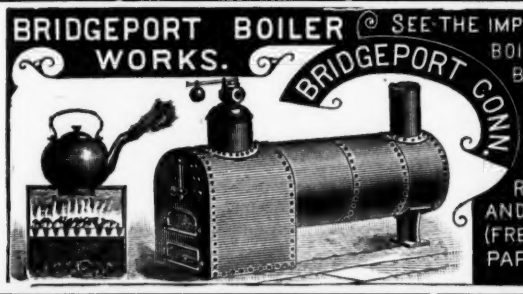
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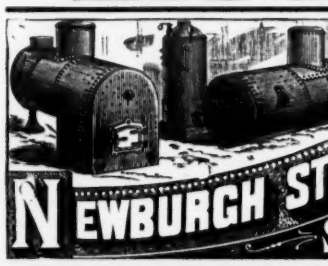
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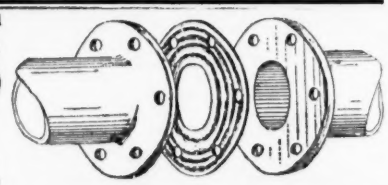

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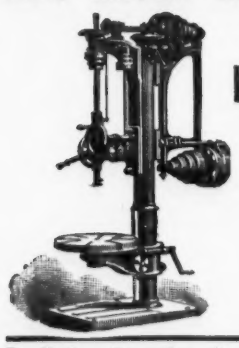
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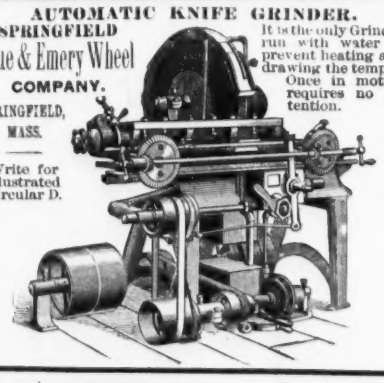
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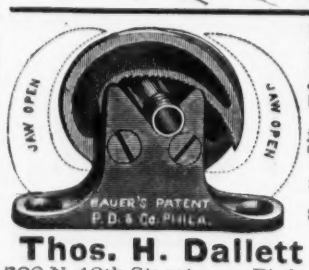

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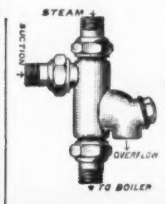

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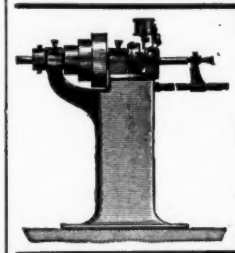
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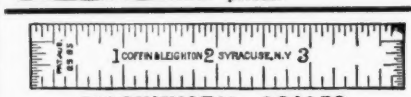

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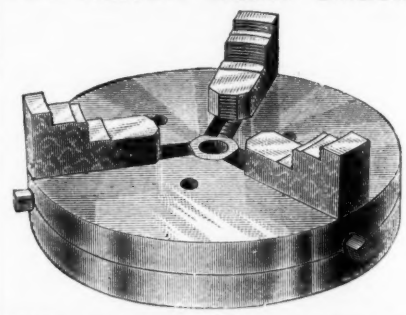
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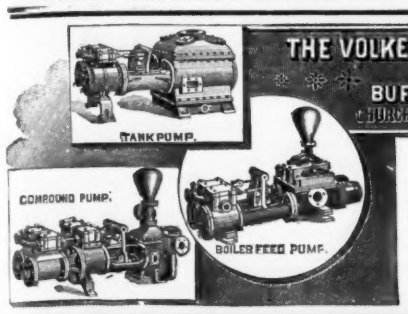

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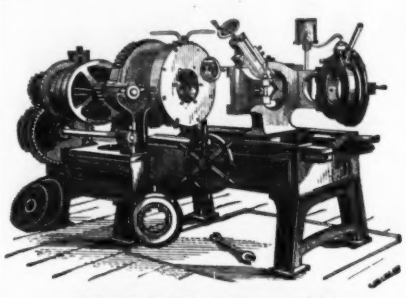

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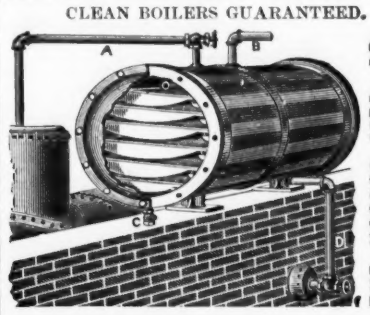

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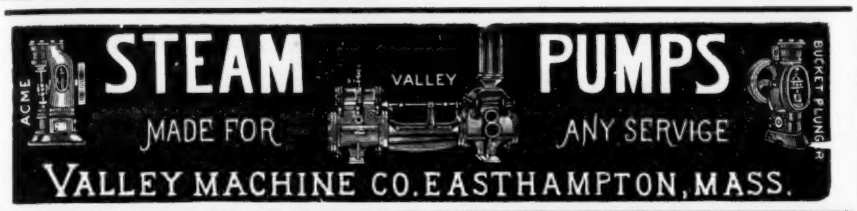

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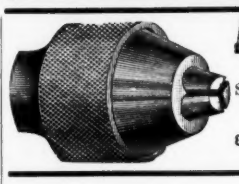

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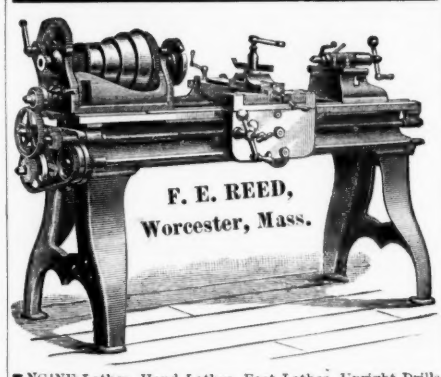

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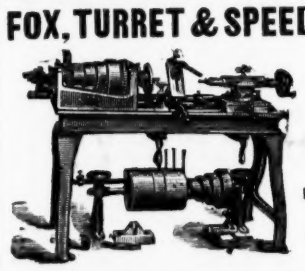

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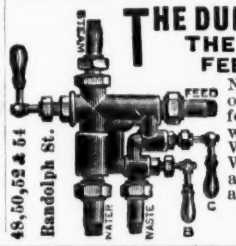

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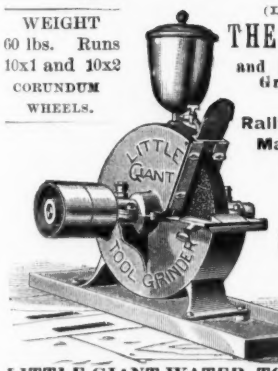

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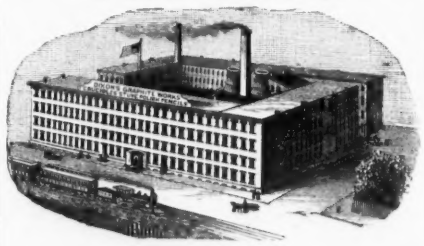

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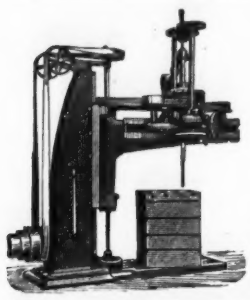

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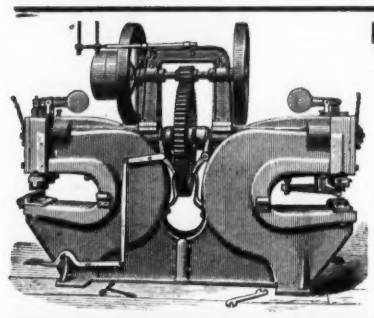

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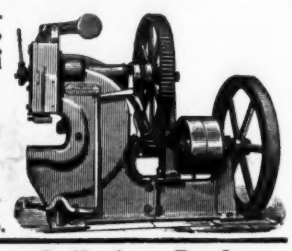

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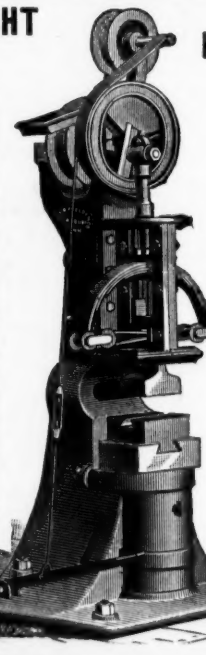

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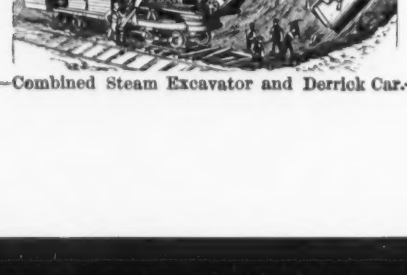

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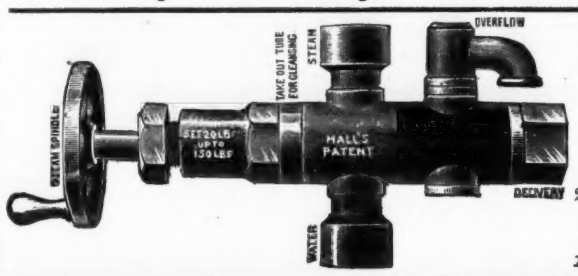

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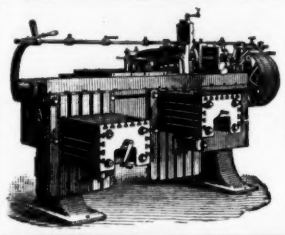

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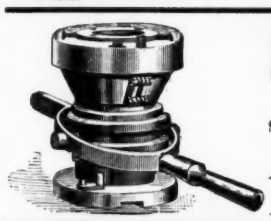

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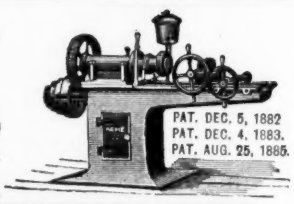

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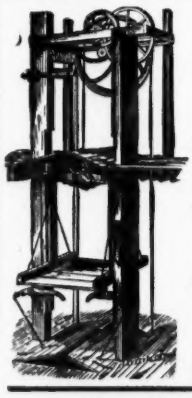

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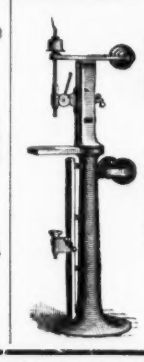

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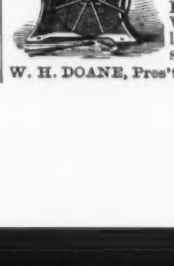

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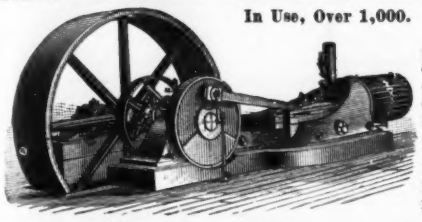

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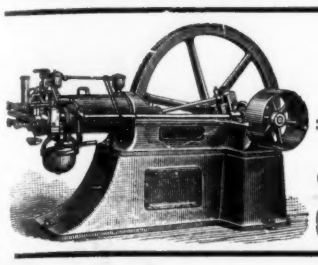

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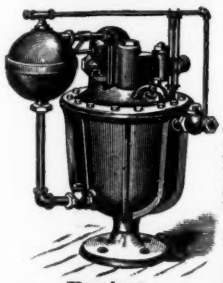

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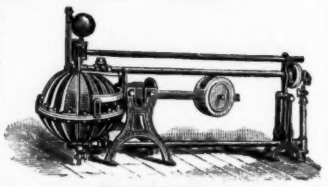

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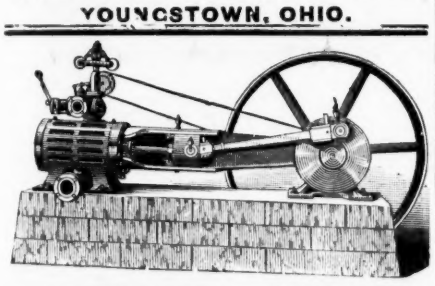

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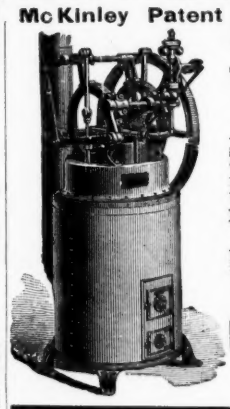

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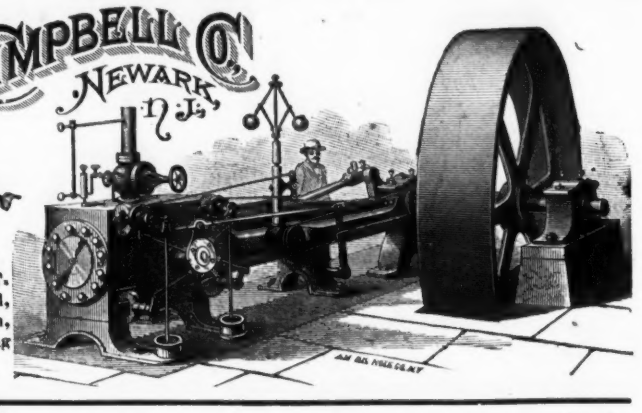

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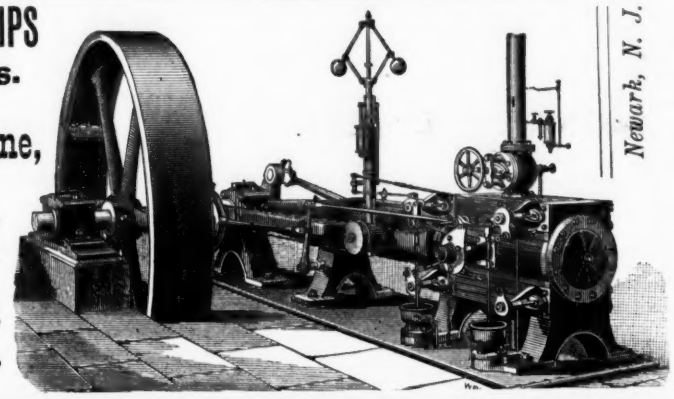

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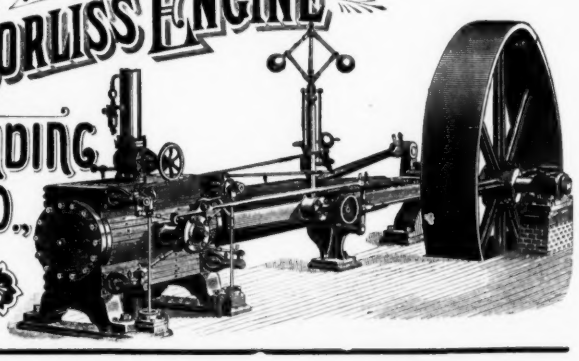

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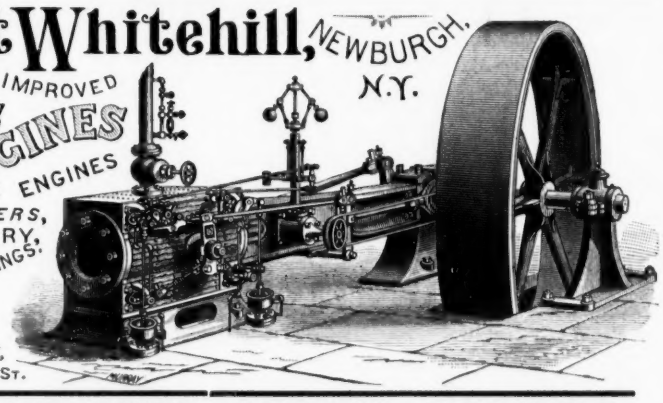

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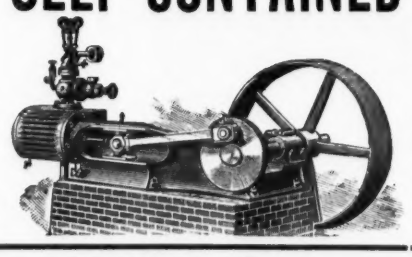

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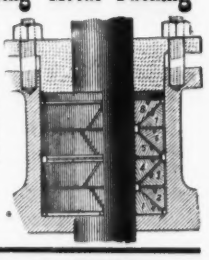

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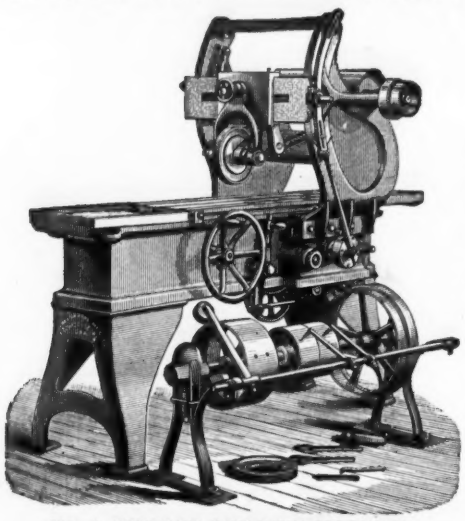

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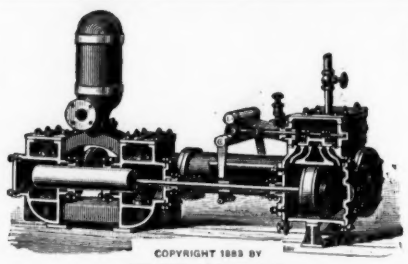

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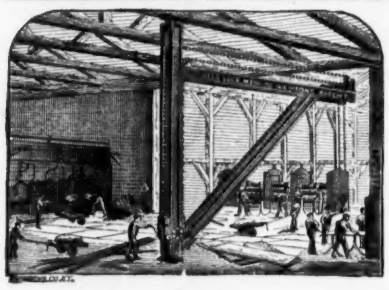

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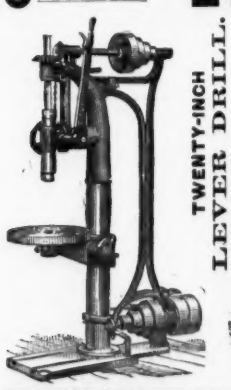

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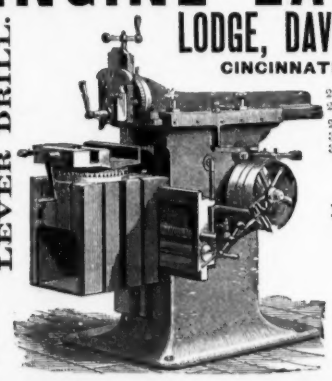

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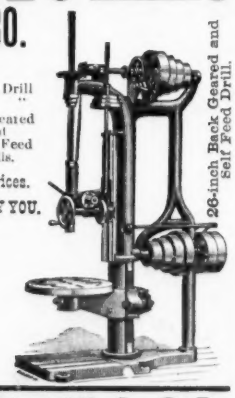

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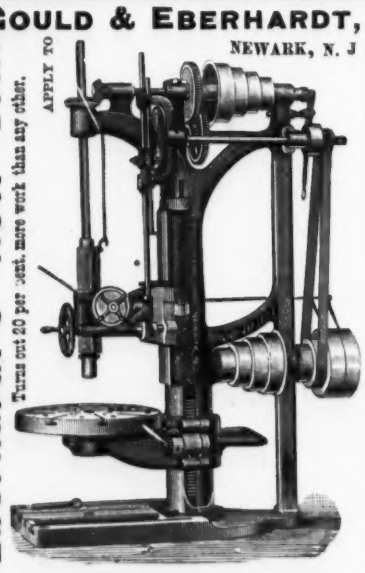

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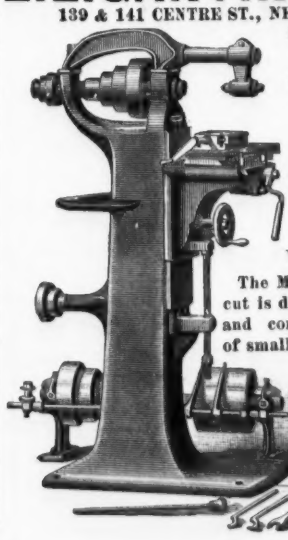

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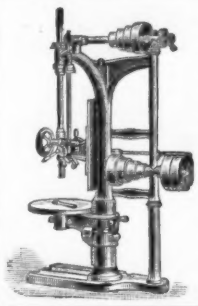

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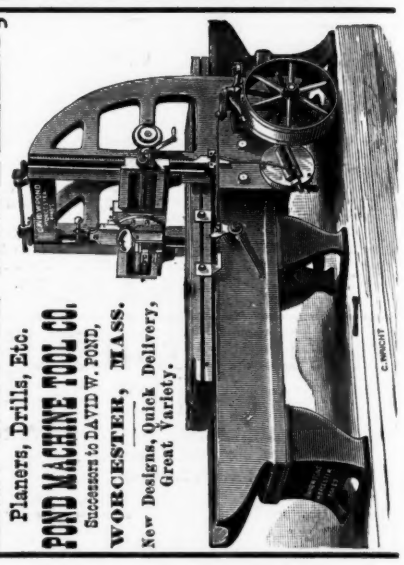

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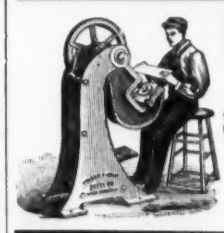

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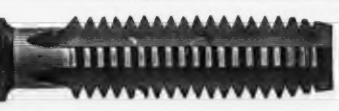

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